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ADDENDA

ANSI/ASHRAE Addendum h to
ANSI/ASHRAE Standard 55-2020

Thermal Environmental Conditions for Human Occupancy

Approved by ASHRAE and the American National Standards Institute on December 30, 2022.

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FOREWORD

Addendum h to Standard 55-2020 makes multiple changes to the standard, including the following:

- *Adds a new definition for "comfort zone" and updates related definitions.*
- *Removes the concept of a separate elevated airspeed "method" and replaces it with a reference to an "adjustment" to the standard method. This change includes edits to Appendix A, where a flow chart is added to guide users through the various models that underpin the standard*
- *Replaces the word "acceptable" with "satisfactory" throughout the standard.*
- *Rewrites Appendix H to account for recent changes in the standard and to better explain the concept of comfort zones.*
- *Updates the example surveys provided in Appendix L and associated language.*

Note: In this addendum, changes to the current standard are indicated in the text by underlining (for additions) and ~~strikethrough~~ (for deletions) unless the instructions specifically mention some other means of indicating the changes.

Addendum h to Standard 55-2020

Modify Section 1 as shown.

1. PURPOSE

The purpose of this standard is to specify the combinations of indoor thermal environmental factors and personal factors that will produce satisfactory thermal environmental conditions ~~acceptable to~~ for a majority of the occupants within the space.

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

~~comfort,~~ thermal comfort: that condition of mind that expresses satisfaction with the thermal environment and is assessed by subjective evaluation.

environment, ~~acceptable~~ satisfactory thermal: a thermal environment that a substantial majority (more than 80%) of the occupants find ~~thermally acceptable~~satisfactory.

~~thermal~~ zone, thermal: 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).

~~zone,~~ comfort zone: ~~those combinations of air temperature, mean radiant temperature tr, and humidity that are predicted to be an acceptable thermal environment at particular values of air speed, metabolic rate, and clothing insulation Icl.~~ a zone whose boundaries enclose sets of environmental and personal conditions that provide thermal satisfaction according to the standard.

Remove Table 5-5 as shown below.

~~Table 5-5 Applicability of Methods for Determining Acceptable Thermal Environments in Occupied Spaces~~

~~Average Air Speed, m/s (fpm)~~	~~Humidity Ratio~~	~~met~~	~~clo~~	~~Comfort Zone Method~~
~~<0.20 (40)~~	~~All~~	~~1.0 to 2.0~~	~~0 to 1.5~~	~~Section 5.3.1, "Analytical Comfort Zone Method"~~
~~>0.20 (40)~~	~~All~~	~~1.0 to 2.0~~	~~0 to 1.5~~	~~Section 5.3.2, "Elevated Air Speed Comfort Zone Method"~~

Modify Section 5.3 as shown. The remainder of Section 5.3 is unchanged.

5.3 ~~Method for~~ Determining ~~Acceptable~~ Satisfactory Thermal Environment in Occupied Spaces~~.~~

5.3.1 Applicability. Section 5.3 is permitted to be used to determine the requirements for thermal comfort in all occupied spaces within the scope of this standard. See Sections 5.2.1.4 and 5.2.2.3 for limits to the occupants' clothing and activity levels.

~~Acceptable thermal environments shall be determined using one of the two methods shown in Table 5-5 and any applicable requirements of Sections 5.3.3 and 5.3.4.~~

~~***Informative Note:*** Average air speed and average air temperature have precise definitions in this standard. See Section 3 for all defined terms.~~

~~**5.3.1 Analytical Comfort Zone Method**~~

~~**5.3.1.1 Applicability.** It is permissible to apply the method in this section to all spaces within the scope of this standard where the occupants have activity levels that result in average metabolic rates between 1.0 and 4.0 met, clothing insulation I_{cl} between 0.0 and 1.5 clo, and average air speeds V_a greater than 0.10 m/s (20 fpm).~~

5.3.2~~1.2~~ Methodology. ~~The computer code in Normative Appendix B is to be used with this standard.~~ The PMV model with adjustments for solar radiation and elevated air speed is used to determine the boundaries of the comfort zone. Compliance with Section 5.3 is achieved if –0.5 < PMV < +0.5 and the requirements of Sections 5.3.5 and 5.3.6 are met. See Section 6 for full design compliance requirements.

A computer code implementation of the PMV model is provided in Normative Appendix B. The adjustment for solar radiation is described per Section 5.3.3 and Normative Appendix C. The adjustment for elevated air speed is described in Section 5.3.4 and Normative Appendix D.

Normative Appendices A, B, C, and D provide the full methodology to comply with this section, including computer code implementations. The Thermal Comfort Tool[3] includes these methods and is permitted to be used to comply with this section. Alternative calculation methods are permitted, but~~. If any other method is used,~~ it is the user's responsibility to verify and document that the method used yields the same results. ~~The Thermal Comfort Tool[3] is permitted to be used to comply with this section.~~

Figures 5-2 and 5-3 provide~~s~~ graphical examples of comfort zones using the PMV model in still-air conditions~~Analytical Comfort Zone Method~~. Direct use of these charts to comply with ~~the Analytical Comfort Zone Method~~this section is allowable for the specific input conditions described on each chart. In each figure, the darker shade comfort zone is the same, and the lighter shade comfort zone represents a single altered input (a) clothing insulation and (b) metabolic rate.

~~***Informative Note:*** See Informative Appendix L for further explanation of predicted mean vote (PMV) and its relationship to predicted percentage dissatisfied (PPD).~~

5.3.3~~1.2.1~~ Solar Radiation Adjustment. When direct-beam solar radiation falls on a representative occupant, the mean radiant temperature $\overline{t_r}$ shall account for long-wave mean radiant temperature $\overline{t_{rlw}}$ and short-wave mean radiant temperature $\overline{t_{rsw}}$ using one of the following options:

[. . .]

~~**5.3.2 Elevated Air Speed Comfort Zone Method**~~

~~**5.3.2.1 Applicability.** It is permissible to apply the method in this section to all spaces within the scope of this standard where the occupants have activity levels that result in average metabolic rates between 1.0 and 2.0 met, clothing insulation I_{cl} between 0.0 and 1.5 clo, and average air speeds V_a greater than 0.20 m/s (40 fpm).~~

~~**5.3.2.2 Methodology.** The calculation method in Normative Appendix D is to be used with this method. This method uses the Analytical Comfort Zone Method in Section 5.3.1 combined with the Standard Effective Temperature (SET) model described in Normative Appendix D.~~

~~Figure 5-4 represents two particular cases (0.5 and 1.0 clo) of the Elevated Air Speed Comfort Zone Method and shall be permitted as a method of compliance for the conditions specified in the figure. The figure also defines comfort zones for air movement with occupant control (darkly shaded; Section 5.3.2.3) versus without occupant control (lightly shaded; Section 5.3.2.4). It is permissible to determine the operative temperature range by linear interpolation between the limits found for each zone in Figure 5-4.~~

~~Figure 5-5 provides a graphical example of a comfort zone using the Elevated Air Speed Comfort Zone Method (lighter shade zone; Section 5.3.2.3) compared to one using the Analytical Comfort Zone Method (darker shade zone; Section 5.3.1). Direct use of this chart to comply with the Elevated Air Speed Comfort Zone Method using the lighter shade zone is allowable for the specific input conditions described on the chart.~~

~~Alternative methods are permitted. If any other method is used, the user shall verify and document that the method used yields the same results. The Thermal Comfort Tool[3] is permitted to be used to comply with this section.~~

~~When direct-beam solar radiation falls on a representative occupant, the mean radiant temperature ($\overline{t_r}$) shall account for long-wave mean radiant temperature ($\overline{t_{rlw}}$) and short-wave mean radiant temperature ($\overline{t_{rsw}}$) in accordance with Section 5.3.1.2.1.~~

~~Figure 5-6 describes the steps for determining the limits to air speed inputs in SET model.~~

5.3.4 Elevated Air Speed Adjustment. For air speeds above 0.1 m/s (20 fpm), the Standard Effective Temperature (SET) model is used in conjunction with the PMV model as described in Normative Appendix D.

Figure 5-4 represents two particular cases (0.5 and 1.0 clo) of the comfort zone across the range of indoor air speeds, and shall be permitted as a method of compliance for the conditions specified in the figure. The figure also defines comfort zones for air movement with occupant control (darkly shaded; Section 5.3.4.1) versus without occupant control (lightly shaded; Section 5.3.4.2). It is permissible to determine the operative temperature range by linear interpolation between the limits found for each zone in Figure 5-4.

Figure 5-5 provides a graphical example of comfort zones for two air speeds. Direct use of this chart to comply with the standard is allowable for the specific input conditions described on the chart.

Figure 5-6 describes the steps for determining the limits to air speed inputs.

Modify captions for Figures 5-2, 5-3, 5-4, 5-5, 5-6 as shown.

Figure 5-2 ~~Analytical~~ Comfort ~~Z~~zone ~~Method~~ example—effect of increased clo value.

Figure 5-3 ~~Analytical~~ Comfort ~~Z~~zone ~~Method~~ example—effect of increased met value.

Figure 5-4 ~~Acceptable~~ Satisfactory ranges of operative temperature t_o and average air speed V_a for 1.0 and 0.5 clo comfort zones at humidity ratio 0.010.

Figure 5-5 Elevated ~~A~~air ~~S~~speed ~~C~~comfort ~~Z~~zone ~~Method~~ example (lightly shaded zone) compared to the ~~Analytical~~ still-air ~~C~~comfort ~~Z~~zone ~~Method~~ example (darkly shaded zone).

Figure 5-6 Flowchart for determining limits to air speed inputs in the ~~E~~elevated ~~A~~air ~~S~~speed ~~C~~comfort ~~Z~~zone Method.

Modify subsequent headings of Section 5.3 and associated references within the standard as shown.

5.3.~~2~~4.~~3~~1 Average Air Speed V_a with Occupant Control. Section ~~5.3.2~~5.3.4.~~4~~2 does not apply when the occupants have control over average air speed V_a and one of the following criteria is met:

[. . .]

5.3.4~~2~~.2~~.4~~ Average Air Speed V_a without Occupant Control. If occupants do not have control over the local air speed, meeting the requirements of Section ~~5.3.2~~5.3.4.~~3~~1, the following limits apply to the SET model and to Figure 5-4.

[. . .]

Exceptions 5.3.4~~2~~.2~~4~~(c):

[. . .]

5.3.~~3~~5 Local Thermal Discomfort

5.3.5~~3~~.1 Applicability. The requirements specified in this section are required to be met only when representative occupants meet both of the following criteria:

[. . .]

5.3.~~3~~5.2 Radiant Temperature Asymmetry.

[. . .]

5.3.5~~3~~.3 Ankle Air Speed.

[. . .]

Exception to 5.3.~~3~~5.3: The requirement in this section does not apply when using elevated air speed in Section ~~5.3.3~~5.3.5.

5.3.5~~3~~.4 Vertical Air Temperature Gradient. Air temperature gradient between head level and ankle level shall not exceed the value resulting from the following formula or in the shaded region of Figure 5-7~~.3.5~~.

[. . .]

Exception to ~~5.3.3~~5.3.5.4: The requirement in this section does not apply when using elevated air speed in Section ~~5.3.3~~5.3.5.

Informative Note: Refer to the informative note in Section ~~5.3.3~~5.3.5.1.

~~5.3.3~~5.3.5.5 Floor Surface Temperature. When representative occupants are seated with feet in contact with the floor, floor surface temperatures within the occupied zone shall be 19°C to 29°C (66.2°F to 84.2°F).

[. . .]

~~5.3.4~~5.3.6 Temperature Variations with Time

~~5.3.4~~5.3.6.1 Applicability. The fluctuation requirements of this section shall be met when they are not under the direct control of the individual occupant.

~~5.3.4~~5.3.6.2 Cyclic Variations. Cyclic variations in operative temperature t_o that have a period not greater than 15 minutes shall have a peak-to-peak amplitude not greater than 1.1°C (2.0°F).

~~5.3.4~~5.3.6.3 Drifts or Ramps. Monotonic, noncyclic changes in operative temperature t_o and cyclic variations with a period greater than 15 minutes shall not exceed the most restrictive requirements from Table 5-12.

[. . .]

Modify Section 6 as shown. The remainder of Section 6 is unchanged.

6.1.1 Design Thermal Environmental Control Classification. For all projects demonstrating compliance through Section 5.3~~.1, 5.3.2, or 5.3.3~~, design compliance shall indicate the Thermal Environmental Control Classification Level in accordance with Table 6-1 of each space type within the building.

[. . .]

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: ~~Analytical Comfort Zone Method (Section 5.3.1), Elevated Air Speed Comfort Zone Method (Section 5.3.2)~~Section 5.3~~,~~ 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 *ASHRAE Handbook—Fundamentals*[1], Chapter 14), and total indoor loads shall be stated. The design exceedance hours (***Informative Note:*** 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~~ a satisfactory level of comfort is not being provided to any representative occupants, this shall be stated. Where Table 5-1 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 used 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~~ satisfactory 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.~~1.2.1~~3 used for compliance, and the resultant mean radiant temperature $\bar{t}_r$.
i. Thermal Environmental 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.

[. . .]

Modify Section 7 as shown. The remainder of Section 7 is unchanged.

7.2.1 Comfort Determination from Occupant Surveys. ~~Acceptability and s~~Satisfaction ~~are~~is directly determined from the responses of occupants using the scales and comfort limits described in Section 7.3.1.

[. . .]

7.2.2.1 Mechanically Conditioned Spaces. Use Section 5.3~~.1, "Analytical Comfort Zone Method,"~~ to determine the comfort of occupants under the measured environmental conditions. 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.~~2~~4 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 ~~5.3.3~~5.3.5) and to limits to rate of temperature change over time, as specified in Section ~~5.3.4~~5.3.6.

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. Air speed, unless it can be otherwise demonstrated that, within the space, average air speed V_a meets the requirements of Section 5.3.~~2~~4
e. Control measures for environmental factors

[. . .]

7.3 Measurement Methods

7.3.1 Surveys of Occupant Responses to Environment. Surveys shall be solicited from the entire occupancy or a representative sample thereof. If more than 45 occupants are solicited, the response rate must exceed 35%. If solicited occupants number between 20 and 45, at least 15 must respond. For under 20 solicited occupants, 80% must respond.

Informative Note: Refer to Informative Appendix L for further discussion of surveys, including examples.

[. . .]

7.3.1.2 Point-in-Time Surveys. Point-in-time surveys shall be solicited during times representative of the building's occupancy.

a. Thermal ~~acceptability~~ satisfaction questions shall include a continuous or seven-point scale ending with the choices "very ~~unacceptable~~dissatisfied" and "very ~~acceptable~~satisfied."
b. Thermal sensation questions shall include the ASHRAE seven-point thermal sensation scale subdivided as follows: cold, cool, slightly cool, neutral, slightly warm, warm, hot.
c. Thermal preference questions shall use the three-point scale 'cooler' 'without change', 'warmer'.

~~Point-in-time surveys shall be solicited during times representative of the building's occupancy.~~

7.3.2 Physical Measurement Positions within the Building

a. **Floor plan.** Thermal environment measurements shall be made in the building at a representative sample of locations where the occupants are known to, or are expected to, spend their time. When performing evaluation of similar spaces in a building, it shall be permitted to select a representative sample of such spaces.

   If occupancy distribution cannot be observed or estimated, the measurement locations shall include both of the following:

   1. The center of the room or space
   2. 1.0 m (3.3 ft) inward from the center of each of the room's walls. In the case of exterior walls with windows, the measurement location shall be 1.0 m (3.3 ft) inward from the center of the largest window.

   Measurements shall also be taken in locations where the most extreme values of the thermal parameters are observed or estimated to occur (e.g., potentially occupied areas near windows, diffuser outlets, corners, and entries).

b. **Height above floor.** Air temperature and average air speed V_a shall be measured at the 0.1, 0.6, and 1.1 m (4, 24, and 43 in.) levels for seated occupants at the plan locations specified in Section 7.3.2(a)(1) and 7.3.2(a)(2). Measurements for standing occupants shall be made at the 0.1, 1.1, and 1.7 m (4, 43, and 67 in.) levels and measurements for horizontal occupants shall be made at the mean height of the body. Operative temperature t_o or PMV shall be measured or calculated at the 0.6 m (24 in.) level for seated occupants, the 1.1 m (43 in.) level for standing occupants, and the mean height of the body for horizontal occupants. Floor temperature that may cause local discomfort shall be measured at the surface by contact thermometer or infrared thermometer (Section ~~5.3.3~~5.3.5.5).

   Radiant temperature asymmetry that may cause local thermal discomfort (Section ~~5.3.3~~5.3.5.4) shall be measured in the affected occupants' locations, with the sensor oriented the greatest surface temperature difference.

[. . .]

7.4.1 Evaluation Based on Survey Results

a. The ~~probability~~ percentage of occupants satisfied shall be ~~predicted~~ calculated from seven-point satisfaction survey scores by dividing the number of votes falling between ~~–~~+1 and +3, inclusive, by the total number of votes. Responses to diagnostic dissatisfaction questions shall be tallied by category.

b. For point-in-time surveys, comfort shall be evaluated using votes on the ~~acceptability~~ satisfaction and/or thermal sensation scales. On the ~~acceptability~~ satisfaction scale, votes between +1~~0~~ (~~neutral~~slightly satisfied) and +3 (“very ~~acceptable~~satisfied”), inclusive, shall be divided by total votes to obtain the ~~probability~~ percentage of ~~comfort acceptability~~thermal satisfaction observed during the survey period. On the seven-point thermal sensation scale, votes between –1~~.5~~ and +1~~.5~~, inclusive, shall be divided by total votes to obtain the ~~probability~~ percentage of ~~comfort acceptability~~thermal satisfaction observed during the survey period.

[. . .]

7.4.2.1 Approaches to Predicting whether a Thermal Environment is ~~Acceptable~~ Satisfactory at a Specific Instance in Time

a. Mechanically conditioned buildings:
   1. Occupied spaces shall be evaluated using the PMV ~~and SET~~ comfort zone as defined in Sections ~~5.3.2~~5.3.4.
   2. Local thermal discomfort shall be evaluated using the limits to environmental asymmetry prescribed in Section ~~5.3.3~~5.3.5.

b. Buildings with occupant-controlled operable windows:
   1. Occupied spaces shall be evaluated using the indoor operative temperature t_o contours of the adaptive model comfort zone in Section 5.4, including the contour extensions for average air speeds V_a above 0.3 m/s (59 fpm).

7.4.2.2 Approaches to Predicting whether a Thermal Environment is ~~Acceptable~~ Satisfactory over Time.

[. . .]

Modify Normative Appendix A as shown. The remainder of Normative Appendix A is unchanged.

NORMATIVE APPENDIX A
OPERATIVE TEMPERATURE AND PROCEDURE FOR SECTION 5.3

A1. METHODS FOR DETERMINING OPERATIVE TEMPERATURE

[. . .]

A2. PROCEDURE FOR DETERMINING SATISFACTORY THERMAL ENVIRONMENT IN OCCUPIED SPACES PER SECTION 5.3

The PMV model with adjustments for solar radiation and elevated air speed is used to determine the boundaries of the comfort zone per the calculation methods described in Appendices B through D. These calculation methods are incorporated in the Thermal Comfort Tool[3]. The flowchart in Figure A-1 provides the procedure for how these calculation methods should be applied.

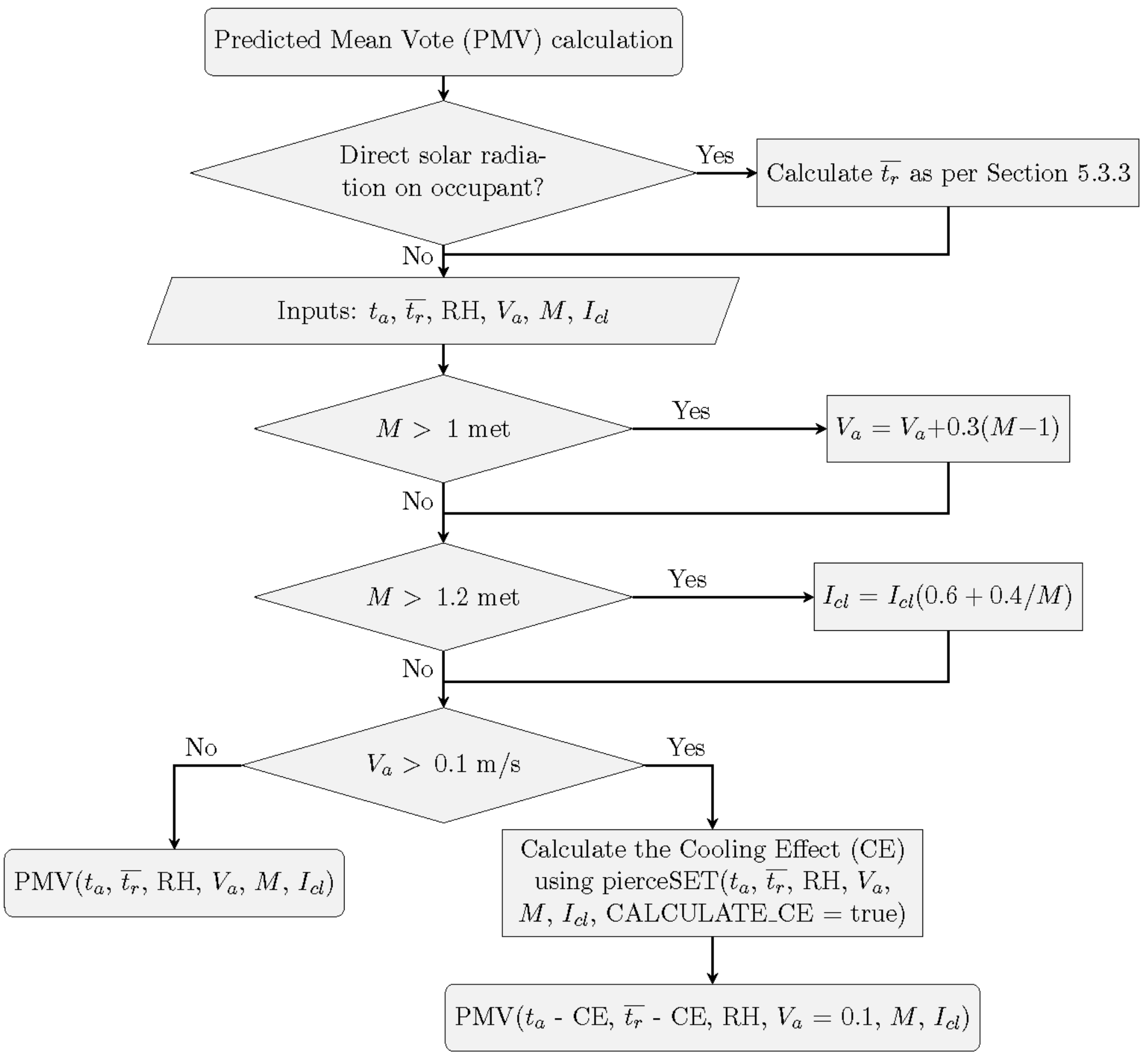


Figure A-1 Flowchart describing process of calculation methods used in Section 5.3

Modify Normative Appendix B as shown. The remainder of Normative Appendix B is unchanged.

NORMATIVE APPENDIX B
COMPUTER PROGRAM FOR CALCULATION OF PMV~~-PPD~~

The following code is one implementation of the PMV~~-PPD~~ calculation using JavaScript in SI units. This calculation does not include discomfort risk due to local discomfort factors. The input variable *clo* in the PMV function shall be calculated using the following equation:

$$\text{clo} = I_{cl} \times (0.6 + 0.4/M) \text{ for M} \geq 1.2$$

$$\text{clo} = I_{cl} \text{ for } M < 1.2$$

where M is the metabolic rate in met units and I_{cl} is the clothing insulation.

The input variable *vel* in the PMV function is the sum of the average air speed (V) plus the activity-generated air speed (V_{ag})~~ (m/s). Where V_{ag} is the activity-generated air speed~~ caused by motion of individual body parts (m/s). It is a function of metabolic rate and is added to the average air speed to determine convective cooling of the body. V_{ag} is assumed to be 0 for metabolic rates equal and lower than 1 met and otherwise equal to

[. . .]

Modify Normative Appendix D As shown. The remainder of Normative Appendix D is unchanged.

D1. CALCULATION OVERVIEW

Section 5.3 requires that the ~~E~~elevated ~~A~~air ~~S~~speed adjustment~~Comfort Zone Method~~ be used when average air speed *Va* is greater than 0.10 m/s (40 fpm). ~~The SET model shall be used to account for the cooling effect of air speeds greater than the maximum allowed in the Analytical Comfort Zone Methods.~~ This appendix describes the calculation procedures for the ~~E~~elevated ~~A~~air ~~S~~speed adjustment~~Comfort Zone Method~~.

[. . .]

Modify Informative Appendix E as shown. The remainder of Informative Appendix E is unchanged.

E1. INTRODUCTION

Thermal comfort is that condition of mind that expresses satisfaction with the thermal environment. Because there are large variations, physiologically and psychologically, from person to person, it is difficult to satisfy everyone in a space. The environmental conditions required for comfort are not the same for everyone. Extensive laboratory and field data have been collected that provide the necessary statistical information to define conditions that a specified percentage of occupants will find thermally comfortable.

Note that the pairs of terms “satisfaction”/“acceptability”, “satisfactory”/“acceptable”, and “are satisfied with”/“accept” are each considered synonymous in the standard, though the standard uses “satisfaction” as its standard nomenclature.

[. . .]

E3. VARIATION AMONG OCCUPANTS

[. . .]

In some cases, it will not be possible to achieve ~~an acceptable~~a satisfactory thermal environment for all occupants of a space due to individual differences, including activity and/or clothing. If the requirements are not met for some known set of occupants, then the standard requires that these occupants be identified.

E4. TEMPORAL VARIATION

It is possible for all six primary factors to vary with time. This standard only addresses thermal comfort in a steady state (with some limited specifications for temperature variations with time in Section ~~5.3.4~~5.3.6).

[. . .]

E5. LOCAL THERMAL DISCOMFORT

Nonuniformity is addressed in Section ~~5.3.3~~5.3.5. Factors 1 through 6 may be nonuniform over an occupant’s body, and this nonuniformity may be an important consideration in determining thermal comfort.

[. . .]

Modify Informative Appendix H as shown.

INFORMATIVE APPENDIX H
COMFORT ZONES DEFINING SATISFACTORY THERMAL CONDITIONS IN OCCUPIED SPACES~~COMFORT ZONE METHODS~~

H1. ~~DETERMINING ACCEPTABLE THERMAL CONDITIONS IN OCCUPIED SPACES~~INTRODUCTION

~~This standard recommends a specific percentage of occupants that constitutes acceptability and values of the thermal environment associated with this percentage.~~

~~For given values of humidity, air speed, metabolic rate, and clothing insulation, a comfort zone may be determined. The comfort zone is defined in terms of a range of operative temperatures to that provide acceptable thermal environmental conditions or in terms of the combinations of air temperature and mean radiant temperature that people find thermally acceptable.~~

~~See Normative Appendix A and ASHRAE Handbook—Fundamentals[1], Chapter 9, for procedures~~

~~to calculate operative temperature to. Dry-bulb temperature is a proxy for operative temperature under certain conditions described in Normative Appendix A.~~

This standard generates comfort zones within the ranges of environmental and personal conditions likely to be found indoors. The boundaries of comfort zones enclose sets of conditions that are considered satisfactory by their occupancies. They are based on predicted values of how occupants on average evaluate their thermal sensation—specifically, their sense of the environment being warm or cool. Thermal sensation is individually measured by point-in-time survey questionnaires using the ASHRAE seven-point thermal sensation scale.

+3 Hot
+2 Warm
+1 Slightly warm
0 Neutral
–1 Slightly cool
–2 Cool
–3 Cold

Because groups of people in a given environment exhibit considerable variance in their thermal sensation votes, the mean thermal sensation vote is needed to characterize each combination of environmental and personal conditions. In the standard, this mean vote is predicted using the predicted mean vote (PMV) model given in Appendix B. The PMV model calculates the heat balance of a specified occupant and relates their thermal gains or losses to their predicted mean thermal sensation.

~~H2. ANALYTICAL COMFORT ZONE METHOD~~

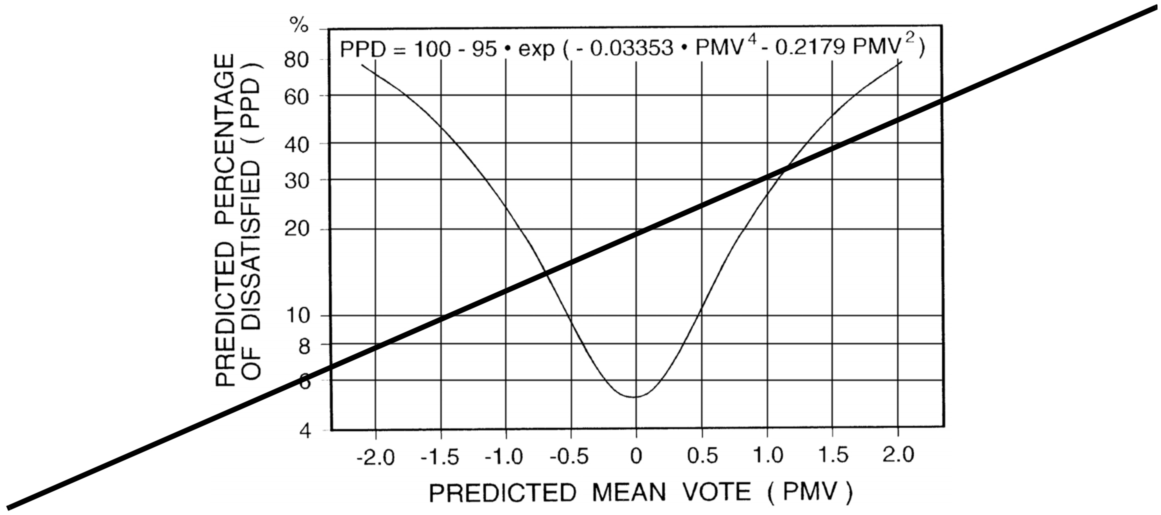
~~This method applies to spaces where the occupants have activity levels that result in average metabolic rates between 1.0 and 4.0 met and where clothing is worn that provides 1.5 clo or less of thermal insulation.~~

~~The ASHRAE thermal sensation scale, which was developed for use in quantifying people's thermal sensation, is defined as follows:~~

~~+3 Hot~~
~~+2 Warm~~
~~+1 Slightly warm~~
~~0 Neutral~~
~~–1 Slightly cool~~
~~–2 Cool~~
~~–3 Cold~~

~~The predicted mean vote (PMV) model uses heat balance principles to relate the six key factors for thermal comfort to the average response of people on the above scale. The predicted percentage dissatisfied (PPD) index is related to the PMV as defined in Figure H-1. It is based on the assumption that people voting +2, +3, –2, or –3 on the thermal sensation scale are dissatisfied and on the simplification that PPD is symmetric around a neutral PMV.~~

~~Table H-1 defines the recommended PPD and PMV range for typical applications.~~



~~**Figure H-1 Predicted percentage dissatisfied (PPD) as a function of predicted mean vote (PMV).**~~

~~**Table H-1 Acceptable Thermal Environment for General Comfort**~~

~~PPD~~	~~PMV Range~~
~~<10~~	~~–0.5 < PMV < +0.5~~

~~The comfort zone is defined by the combinations of the six key factors for thermal comfort for which the PMV is within the recommended limits specified in Table H-1. The PMV model is calculated with the air temperature and mean radiant temperature $\bar{t}_r$ in question, along with the applicable metabolic rate, clothing insulation, air speed, and humidity. If the resulting PMV value generated by the model is within the recommended range, the conditions are within the comfort zone.~~

~~Use of the PMV model in this standard is limited to air speeds below 0.20 m/s (40 fpm). When air speeds exceed 0.20 m/s (40 fpm), the comfort zone boundaries are adjusted based on the SET model described in the elevated air-speed section and in Normative Appendix D.~~

~~Several computer codes are available that predict PMV-PPD. The computer code in Normative Appendix B was developed for use with this standard and is incorporated into the Thermal Comfort Tool[3]. If any other software is used, it is the user's responsibility to verify and document that the version used yields the same results as the code in Normative Appendix B or the Thermal Comfort Tool for the conditions for which it is applied.~~

H2. COMFORT ZONE BOUNDARIES

The boundaries of the comfort zone are defined by equal contours of PMV values. The boundary value is set at ±0.5 PMV in thermal sensation scale units. In field studies of actual buildings, environmental conditions within comfort zones bounded by this ±0.5 value were found satisfactory by roughly 80% of occupants. This percentage varies, depending on additional confounding circumstances beyond the PMV model of an occupant's heat balance. Sources of local discomfort are thought to add to dissatisfaction, as well as other factors such as occupants' sense of personal control over their thermal environment. This effect is described in Informative Appendix L, Sections L1, L2, and L3. The measurement and evaluation methods for determining satisfaction are described in Sections 7.3.1 and 7.4.1 of the standard.

Comfort zones with the ±0.5 PMV boundaries are generated by the Thermal Comfort Tool[3.] They are plotted in psychrometric chart format with air temperature t_a or operative temperature t_o on the abscissa, or in temperature vs. relative humidity format. In evaluating comfort zones, it is usually most useful to use the operative temperature parameter, as surface temperatures within indoor environments will shift along with air temperature across the width of the comfort zone.

The comfort zones are seen to shift continuously with changes to the environmental and personal input parameters that are not plotted on the two chart axes. The presence of solar radiation on the occupant is shown to shift the comfort zone toward the cool side. Elevating the air speed is shown to shift the comfort zone toward the warm side. Note that there is an additional comfort attribute to elevated air speed, that of whether occupants have control of it or not. The presence or absence of group control over air speed produces a subzoning as identified in Figure 5-4. This is also included in the output of the Thermal Comfort Tool[3].

Impacts of personal factors: The outer comfort zone boundaries shift toward the left or right, depending on clo and met level. An increase of 0.1 clo or 0.1 met corresponds approximately to a 0.8°C (1.4°F) or 0.5°C (0.9°F) reduction in operative temperature t_o; a decrease of 0.1 clo or 0.1 met corresponds approximately to a 0.8°C (1.4°F) or 0.5°C (0.9°F) increase in operative temperature.

The computer code in Normative Appendix B was developed for use with this standard and is incorporated into the Thermal Comfort Tool[3]. If any other software is used, it is the user's responsibility to verify and document that the version used yields the same results as the code in Normative Appendix B or the Thermal Comfort Tool for the conditions for which it is applied.

~~H3. ELEVATED AIR-SPEED COMFORT ZONE METHOD~~

~~The outer boundary curves in Figure 5-4 shift toward the left or right, depending on clo and met level. An increase of 0.1 clo or 0.1 met corresponds approximately to a 0.8°C (1.4°F) or 0.5°C (0.9°F) reduction in operative temperature t0; a decrease of 0.1 clo or 0.1 met corresponds approximately to a 0.8°C (1.4°F) or 0.5°C (0.9°F) increase in operative temperature.~~

H~~4~~3. HUMIDITY LIMITS TO THE COMFORT ZONE

There are no established higher or lower humidity limits for thermal comfort; consequently, this standard does not specify a maximum or minimum humidity level. Nonthermal comfort factors, such as skin drying, irritation of mucus membranes, dryness of the eyes, and static electricity generation, may place limits on ~~the acceptability of~~satisfaction with very low humidity environments.

Modify Informative Appendix I as shown. The remainder of Informative Appendix I is unchanged.

I1. LOCAL THERMAL DISCOMFORT

Avoiding local thermal discomfort, whether caused by a vertical air temperature difference between the feet and the head, by an asymmetric radiant field, by local convective cooling (draft), or by contact with a hot or cold floor, is essential to providing ~~acceptable~~ satisfactory thermal comfort.

The requirements specified in Section ~~5.3.3~~5.3.5 of this standard apply directly to a lightly clothed person (with clothing insulation between 0.5 and 0.7 clo) engaged in near-sedentary physical activity (with metabolic rates between 1.0 and 1.3 met). With higher metabolic rates and/or with more clothing insulation, people are less thermally sensitive and, consequently, the risk of local discomfort is lower. Thus, it is acceptable to use the requirements of Section ~~5.3.3~~5.3.5 for metabolic rates greater than 1.3 met and with clothing insulation greater than 0.7 clo, as they will be conservative. People are more sensitive to local discomfort when the whole body is cooler than neutral and less sensitive to local discomfort when the whole body is warmer than neutral. The requirements of Section ~~5.3.3~~5.3.5 of this standard are based on environmental temperatures near the center of the comfort zone. These requirements apply to the entire comfort zone, but they may be conservative for conditions near the upper temperature limits of the comfort zone and may underestimate discomfort at the lower temperature limits of the comfort zone.

Table I-1 shows the expected percent dissatisfied for each source of local thermal discomfort described in Sections ~~5.3.3~~5.3.5.1 through ~~5.3.3~~5.3.5.4. The criteria for all sources of local thermal

discomfort should be met simultaneously at the levels specified for an environment to meet the requirements of Section 5.3 of this standard. The expected percent dissatisfied for each source of local thermal discomfort described in Sections ~~5.3.3~~5.3.5.1 through ~~5.3.3~~5.3.5.4 should be specified.

I2. RADIANT TEMPERATURE ASYMMETRY

The thermal radiation field about the body may be nonuniform due to hot and cold surfaces and direct sunlight. This asymmetry may cause local discomfort and reduce ~~the~~ thermal ~~acceptability~~satisfaction with~~of~~ the space. In general, people are more sensitive to asymmetric radiation caused by a warm ceiling than that caused by hot and cold vertical surfaces. Figure I-1 gives the expected percentage of occupants dissatisfied due to radiant temperature asymmetry caused by a warm ceiling, a cool wall, a cool ceiling, or a warm wall.

[. . .]

I3. DRAFT

[. . .]

Use of elevated air speed to extend the thermal comfort range is appropriate when otherwise occupants are slightly warm, as set forth in Section ~~5.3.2~~5.3.4. When occupants are neutral or cooler, such as under certain combinations of met rate and clo value with operative temperatures t_o below 23°C (73.4°F), average air speeds within the comfort envelope of ±0.5 PMV should not exceed 0.20 m/s (40 fpm). This draft limit applies to air movement caused by the building, its fenestration, and its HVAC system and not to air movement produced by office equipment or occupants. This standard allows average air speed to exceed this draft limit if it is under the occupants' local control and is within the elevated air-speed comfort envelope described in Section ~~5.3.2~~5.3.4.

[. . .]

The air speed limits at 0.1 m (4 in.) in Section ~~5.3.4~~5.3.6.3 are derived by setting PPD_{AD} equal to 20%.

[. . .]

I4. VERTICAL AIR TEMPERATURE GRADIENT

Thermal stratification that results in the air temperature at the head level being warmer than that at the ankle level may cause thermal discomfort. Section ~~5.3.3~~5.3.5.4 of this standard specifies allowable gradients of the air temperature between the head level and ankle level.

[. . .]

The vertical air temperature gradient limits in Section ~~5.3.3~~5.3.5.4. are derived by setting $PPD_{\nabla T}$ equal to 5%.

[. . .]

I5. FLOOR SURFACE TEMPERATURE

Occupants may feel uncomfortable due to contact with floor surfaces that are too warm or too cool. The temperature of the floor, rather than the material of the floor covering, is the most important factor for foot thermal comfort while wearing shoes. Figure I-4 gives the percentage of occupants expected to be dissatisfied due to floor temperature t_f based on people wearing lightweight indoor shoes. Thus, it is acceptable to use these criteria for people wearing heavier footgear, as they will be conservative. This standard does not address the floor temperature required for people not wearing shoes, nor does it address ~~acceptable~~ satisfactory floor temperatures for people sitting on the floor.

[. . .]

I7. CYCLIC VARIATIONS

Cyclic variations refer to those situations where the operative temperature t_o repeatedly rises and falls and the period of these variations is not greater than 15 minutes. If the period of the fluctuation cycle exceeds 15 minutes, the variation is treated as a drift or ramp in operative temperature, and the requirements of Section ~~5.3.4~~5.3.6.2 apply. In some situations, variations with a period not greater than 15 minutes are superimposed on variations with a longer period. In these situations, the requirements of Section ~~5.3.4~~5.3.6.1 apply to the component of the variation with a period not greater than 15 minutes, and the requirements of Section ~~5.3.4~~5.3.6.2 apply to the component of the variation with a period greater than 15 minutes.

I8. DRIFTS OR RAMPS

Temperature drifts and ramps are monotonic, noncyclic changes in operative temperature t_o. The requirements of Section ~~5.3.4~~5.3.6.2 also apply to cyclic variations with a period greater than 15 minutes. Generally, "drifts" refer to passive temperature changes of the enclosed space, and "ramps" refer to actively controlled temperature changes.

Section ~~5.3.4~~5.3.6.2 specifies the maximum change in operative temperature t_o allowed during a period of time. For any given time period, the most restrictive requirements from Table 5-11 apply. For example, the operative temperature may not change more than 2.2°C (4.0°F) during a 1.0 hour period, and it also may not change more than 1.1°C (2.0°F) during any 0.25 hour period within that 1.0 hour period. If the user creates variations as a result of control or adjustments, higher values may be acceptable.

These local thermal comfort criteria were developed in order to keep the expected percent of occupants who are dissatisfied due to all of these local discomfort factors at or below 10%. The operative temperature t_o ranges required in the standard were developed in order to keep the predicted percent dissatisfied of occupants due to operative temperature only, without factoring in local thermal factors. When both local discomfort factors and operative temperature considerations are combined, the goal of this standard to standardize satisfactory thermal conditions ~~acceptable to~~ or a substantial majority of occupants (80%) is achieved. This is especially true if there is some overlap between those who are dissatisfied due to local factors and those who are dissatisfied due to operative temperature.

Modify Informative Appendix J as shown. The remainder of Informative Appendix J is unchanged.

[. . .]

For spaces that meet these criteria, it is acceptable to determine the allowable indoor operative temperatures t_o from Figure 5-8. This figure includes two sets of operative temperature limits, one for 80% ~~acceptability~~ satisfaction and one for 90% ~~acceptability~~satisfaction. The 80% ~~acceptability~~ satisfaction limits are for typical applications. It is acceptable to use the 90% ~~acceptability~~ satisfaction limits when a higher standard of thermal comfort is desired. Figure 5-8 is based on an adaptive model of thermal comfort that is derived from a global database of 21,000 measurements taken primarily in office buildings.

[. . .]

Figure 5-8 accounts for local thermal discomfort effects in typical buildings, so it is not necessary to address these factors when using this option. If there is reason to believe that local thermal comfort is a problem, it is acceptable to apply the criteria in Section ~~5.3.3~~5.3.5.

Figure 5-8 also accounts for people's clothing adaptation in naturally conditioned spaces by relating the ~~acceptable~~ satisfactory range of indoor temperatures to the outdoor climate, so it is not necessary to estimate the clothing values for the space. No humidity or air speed limits are required when this option is used.

Figure 5-8 includes the effects of people's indoor air speed adaptation in warm climates, up to 0.3 m/s (59 fpm) in operative temperatures t_o warmer than 25°C (77°F). In naturally conditioned spaces where air speeds within the occupied zone exceed 0.3 m/s (59 fpm), the upper ~~acceptability~~ satisfactory temperature limits in Figure 5-8 are increased by the corresponding Δt_0 in Table 5-13, which is based on equal SET values as illustrated in Section ~~5.3.2~~5.3.4. For example, increasing air speed within the occupied zone from 0.3 m/s (59 fpm) to 0.6 m/s (118 fpm) increases the upper ~~acceptable~~ satisfactory temperature limits in Figure 5-8 by a Δt_0 of 1.2°C (2.2°F). These adjustments to the upper satisfactory~~acceptability~~ temperature limits apply only at t_0 > 25°C (77°F) in which the occupants are engaged in near sedentary physical activity (with metabolic rates between 1.0 met and 1.3 met).

Modify Informative Appendix L as shown. The remainder of Informative Appendix L is unchanged.

a. [. . .]

At any given PMV level, a population's proportion of dissatisfied members may be predicted via the predicted percentage dissatisfied (PPD) curve. This is an empirical ~~profit~~probit fit of thermal sensation (TSENS) survey scores obtained in a range of test environments in which dissatisfaction was assumed to occur at TSENS absolute values of 2 or greater. With this method, a PMV of ±0.5 predicts 90% of a population satisfied, or a 10% PPD.

[. . .]

L2. SURVEYING OCCUPANTS

The use of occupant thermal environment surveys is an acceptable way of assessing comfort conditions for the ~~acceptability~~ satisfaction ranges discussed in this standard. With surveys, one may measure the percent who are "satisfied~~,~~" ~~"acceptable,"~~ or "comfortable" by putting those direct questions to a representative sample of the occupants.

[. . .]

L2.1 Point-in-time (~~"~~right-now~~"~~) surveys are used to evaluate ~~thermal sensations of occupants~~ occupants' thermal experience at a single point in time. Thermal comfort researchers have used these surveys to correlate thermal comfort with environmental factors such as those included in the PMV model: metabolic rate, clothing insulation, air temperature, radiant temperature, air speed, and humidity.

A sample point-in-time survey is included in Figure L-1. ~~This is~~It includes a thermal sensation survey that asks occupants to rate their sensation (from "hot" to "cold") on the ASHRAE seven-point thermal sensation scale. The scale units are sometimes designated "TSENS."

~~One may, however, ask~~ It also asks the direct question "~~Is the environment thermally acceptable~~ How satisfied are you with the thermal environment?" with a scale of "very ~~unacceptable~~ dissatisfied" to "very ~~acceptable~~ satisfied." The satisfaction scale is a standard psychometric test in other disciplines and is best divided into seven scale units ~~or more.~~

Preference scales for temperature and air movement are sometimes used in field studies. These are present in both the ASHRAE Global Thermal Comfort Database II and ASHRAE RP-884, *Towards an Adaptive Model of Thermal Comfort and Preference*. A three point scale with "cooler / without change / warmer" for thermal preference and "less air movement / no change / more air movement" for air movement preference is advised. Optional scales are provided for reference.

In order to use the results of a point-in-time survey to assess ~~comfort acceptability ranges~~ satisfaction with the thermal environment over time, the survey would have to be implemented under multiple thermal conditions and in multiple building operating modes. The difficulty of arranging multiple surveys in workplace environments usually limits the feasibility of using the point-in-time survey approach for assessing comfort over time. This limitation may diminish with the ~~advent~~ use of web-based and mobile applications oriented toward building operation.

[. . .]

L2.2

[. . .]

An example thermal satisfaction survey is included in Figure L-2. It asks occupants to rate their satisfaction with their thermal environment (from “very satisfied” to “very dissatisfied”) on a seven-point satisfaction scale. The percentage of occupants satisfied shall be calculated from seven-point satisfaction survey scores by dividing the number of votes falling between +1 and +3, inclusive, by the total number of votes. The percentage of occupants dissatisfied shall be calculated from seven-point satisfaction survey scores by dividing the number of votes falling between –1 and –3, inclusive, by the total number of votes. ~~Acceptability is determined in two ways: by the percentage of occupants who have responded “neutral” through “very satisfied” (0, +1, +2, or +3) with their environment or by taking a slightly broader view of acceptability, including the percentage who have responded (–1, 0, +1, +2, +3)~~.

~~The basic premise of the satisfaction survey is that occupants by nature can recall instances or periods of thermal discomfort, identify patterns in building operation, and provide “overall” or “average” comfort votes on their environment. The surveyor may identify a span of time for the respondents to consider. The occupants provide the time integration.~~

~~Questions to identify the nature (causes) of dissatisfaction may be included in satisfaction surveys (e.g., questions 7a through 7e in Figure L-2).~~

~~Because the survey results encompass a larger time frame, the survey can be administered every six months or repeated in heating and/or cooling seasons. In a new building, the first thermal satisfaction survey may be performed approximately six months after occupancy, late enough to avoid assessing the effects of putting the building into commission but early enough to help identify and solve long-term building problems that have escaped detection in the commissioning process.~~

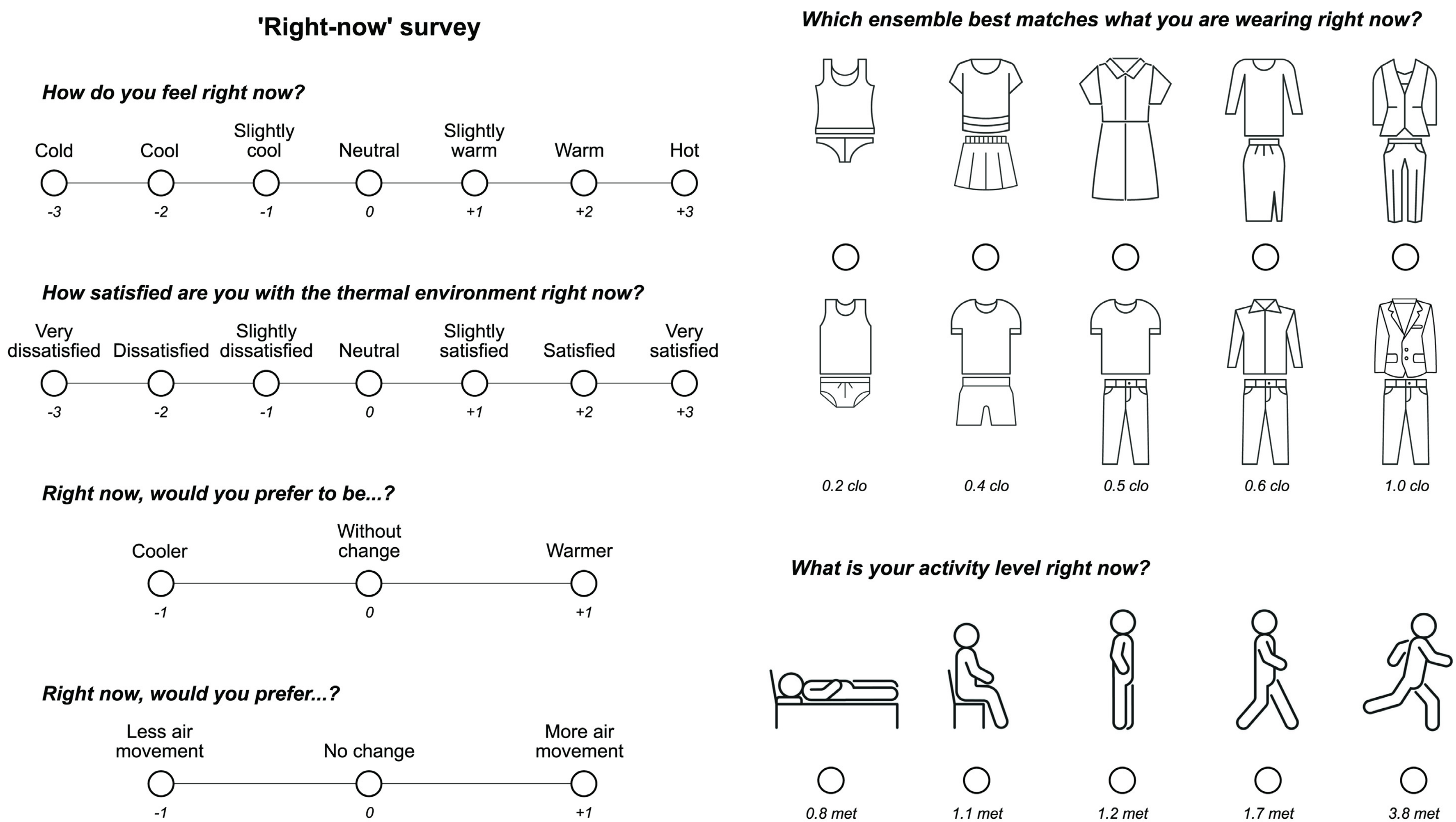
The premise of the satisfaction survey is that occupants can recall instances or periods of thermal discomfort, identify patterns in building operation, and provide “overall” or “average” comfort votes on their environment. The surveyor may identify a span of time for the respondents to consider, and the occupants provide the time integration. Questions to identify the nature (causes) of dissatisfaction may be included in satisfaction surveys (e.g., source-of-discomfort questions in Figure L-2).

As the thermal satisfaction survey assesses a long time frame, it should be administered every six months or repeated in heating and/or cooling seasons. In a new building, the first thermal satisfaction survey may be performed approximately six months after occupancy, late enough to avoid assessing the effects of building commissioning but early enough to help identify long-term building problems that have escaped detection in the commissioning process.

The thermal satisfaction survey can be used by researchers, building operators, and facility managers to assess ~~assessments of~~ building systems’ performance ~~and operation~~ in new buildings, and to perform ~~in addition to~~ periodic ~~postoccupancy~~ post-occupancy evaluation in existing facilities.

[. . .]

Delete current Figures L-1 and L-2 (not shown) and replace with the following.



<u>**Figure L-1 Thermal environment point-in-time survey.**</u>
<u>Note: For all surveys, remove the numerical values under the scales before presenting the survey to occupants. They are used to code responses and analyze results in a standard manner.</u>

Optional Scales

Right now, do you find this environment...?

Extremely uncomfortable	Very uncomfortable	Uncomfortable	Slightly uncomfortable	Comfortable
○	○	○	○	○
-4	*-3*	*-2*	*-1*	*1*

Right now, do you find the thermal environment...?

Clearly unacceptable	Just unacceptable	Neutral	Just acceptable	Clearly acceptable
○	○	○	○	○
-2	*-1*	*0*	*1*	*2*

Right now, do you find the thermal environment...?

Very unpleasant	Unpleasant	Slightly unpleasant	Indifferent	Slightly pleasant	Pleasant	Very pleasant
○	○	○	○	○	○	○
-3	*-2*	*-1*	*0*	*+1*	*+2*	*+3*

Figure L-1 (continued) Thermal environment point-in-time survey.

POE Thermal Comfort module

On which floor is your workspace located?

[integer list]

In which area of the building is your workspace located?

[North, East, South, West, Core, Don't Know]

Are you near (within about 15 feet / 5 meters)...

	No	Yes
A window	○	○
An exterior wall	○	○

How satisfied are you with the temperature in your workspace?

Very dissatisfied	Dissatisfied	Slightly dissatisfied	Neutral	Slightly satisfied	Satisfied	Very satisfied
○	○	○	○	○	○	○
-3	*-2*	*-1*	*0*	*+1*	*+2*	*+3*

If dissatisfied

Go to 'other aspects' question

You have expressed dissatisfaction with the temperature in your workspace. How would you best describe the source of this discomfort? (Check all that apply)

- ☐ Humidity too high (damp)
- ☐ Humidity too low (dry)
- ☐ Air movement too high
- ☐ Air movement too low
- ☐ Incoming sun
- ☐ Drafts from windows or vents
- ☐ My area is hotter than others
- ☐ My area is colder than others
- ☐ Thermostat is inaccessible / controlled by others
- ☐ Heating / cooling system does not respond quickly enough
- ☐ Clothing policy is not flexible enough
- ☐ I can't open or close the windows
- ☐ Other ____________

Figure L-2 Thermal environment satisfaction survey.

In warm / hot weather, the temperature in my workspace is...

- [ ] Often too hot
- [ ] Occasionally too hot
- [ ] Neither too hot nor too cold
- [ ] Occasionally too cold
- [ ] Often too cold

When is this most often a problem? (Check all that apply)

○ *morning* ○ *midmorning* ○ *midday* ○ *afternoon* ○ *evening*

In cool / cold weather, the temperature in my workspace is...

- [ ] Often too hot
- [ ] Occasionally too hot
- [ ] Neither too hot nor too cold
- [ ] Occasionally too cold
- [ ] Often too cold

When is this most often a problem? (Check all that apply)

○ *morning* ○ *midmorning* ○ *midday* ○ *afternoon* ○ *evening*

Please describe any other aspects related to the thermal environment of your workspace that are important to you.

Figure L-2 (continued) Thermal environment satisfaction survey.

POLICY STATEMENT DEFINING ASHRAE'S CONCERN FOR THE ENVIRONMENTAL IMPACT OF ITS ACTIVITIES

ASHRAE is concerned with the impact of its members' activities on both the indoor and outdoor environment. ASHRAE's members will strive to minimize any possible deleterious effect on the indoor and outdoor environment of the systems and components in their responsibility while maximizing the beneficial effects these systems provide, consistent with accepted Standards and the practical state of the art.

ASHRAE's short-range goal is to ensure that the systems and components within its scope do not impact the indoor and outdoor environment to a greater extent than specified by the Standards and Guidelines as established by itself and other responsible bodies.

As an ongoing goal, ASHRAE will, through its Standards Committee and extensive Technical Committee structure, continue to generate up-to-date Standards and Guidelines where appropriate and adopt, recommend, and promote those new and revised Standards developed by other responsible organizations.

Through its *Handbook*, appropriate chapters will contain up-to-date Standards and design considerations as the material is systematically revised.

ASHRAE will take the lead with respect to dissemination of environmental information of its primary interest and will seek out and disseminate information from other responsible organizations that is pertinent, as guides to updating Standards and Guidelines.

The effects of the design and selection of equipment and systems will be considered within the scope of the system's intended use and expected misuse. The disposal of hazardous materials, if any, will also be considered.

ASHRAE's primary concern for environmental impact will be at the site where equipment within ASHRAE's scope operates. However, energy source selection and the possible environmental impact due to the energy source and energy transportation will be considered where possible. Recommendations concerning energy source selection should be made by its members.

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About ASHRAE

Founded in 1894, ASHRAE is a global professional society committed to serve humanity by advancing the arts and sciences of heating, ventilation, air conditioning, refrigeration, and their allied fields.

As an industry leader in research, standards writing, publishing, certification, and continuing education, ASHRAE and its members are dedicated to promoting a healthy and sustainable built environment for all, through strategic partnerships with organizations in the HVAC&R community and across related industries.

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12/22