ADDENDA

ANSI/ASHRAE Addendum e to
ANSI/ASHRAE Standard 55-2013

Thermal Environmental Conditions for Human Occupancy

Approved by ASHRAE on May 29, 2015, and by the American National Standards Institute on June 1, 2015.

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FOREWORD

This addendum removes permissive language found throughout the standard (excluding the title; Sections 1, 2, 3, and 7; and all Informative Appendices). In doing so, values for maximum differences of clothing level and metabolic rate between multiple occupants in a zone that allow averaging into a single representative occupant were established at 0.1 met and 0.15 clo. Reference Addendum b to Standard 55-2013 that is available for free download on the ASHRAE website at https://www.ashrae.org/standards-research--technology/standards-addenda.

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 e to Standard 55-2013

Revise Section 4.1 as follows.

4.1 ~~When~~Where information is required to be identified in this standard, it shall be documented in accordance with and in addition to the requirements in Section 6.

Move the current example from Section 5.2.1.1 into Section 4.3 as follows.

4.3 For each space type, at least one representative occupant shall be identified. If any known set of occupants is excluded from consideration then these excluded occupants shall be identified.

Note: The customers in a restaurant may have a metabolic rate near 1.0 met, while the servers may have a metabolic rate closer to 2.0 met. Per Section 5.2.1.1, each of these groups of occupants shall be considered separately in determining the conditions required for comfort. In some situations such as this, it will not be possible to provide an acceptable level or the same level of comfort to all disparate groups of occupants.

Modify Section 4.5 as follows.

4.5 The thermal environment required for comfort is determined ~~according to~~ in accordance with Section 5 of this standard.

Modify Section 5.2.1.1 as follows (the example is moved to Section 4.3 as noted above).

5.2.1.1 Rate for Each Representative Occupant. For each representative occupant, determine the metabolic rate associated with the occupant's activities. Averaged metabolic rates shall not be used to represent multiple occupants ~~with significantly different metabolic rates~~ whose metabolic rates differ by more than 0.1 met.

~~**Example:** The customers in a restaurant may have a metabolic rate near 1.0 met, while the servers may have a metabolic rate closer to 2.0 met. Each of these groups of occupants shall be considered separately in determining the conditions required for comfort. In some situations such as this, it will not be possible to provide an acceptable level or the same level of comfort to all disparate groups of occupants.~~

Note: For example, in an office setting, when comparing an occupant who is seated and reading at 1.0 met with an occupant that is typing at 1.1 met, they can be grouped as a single representative occupant. If the same seated occupant is compared to an occupant who is seated and filing at 1.2 met, each shall be considered separately when determining the conditions required for thermal comfort.

Modify Section 5.2.1.2 as shown below. The remainder of Section 5.2.1.2 is unchanged.

5.2.1.2 Rate Determination. Use one or a combination of the following methods to determine metabolic rate:

~~a. Use the data presented in Table 5.2.1.2 for the task most comparable to the activity of the representative occupant. Where a range is given, select a single value within that range based on the characteristics of the activity.~~

a. Metabolic rates for typical occupant activity types given in Table 5.2.1.2 shall be used to describe the representative occupant. Where a range is given, select a single value within that range based on characteristics of the activity. If a proposed occupant activity type is not listed in Table 5.2.1.2, the most similar activity type based on characteristics of the activity shall be used.

[…]

Modify Section 5.2.1.3 as follows.

5.2.1.3 Time-Weighted Averaging. Use a time-weighted average metabolic rate for individuals with activities that vary. Such averaging shall not be applied ~~when~~ where an activity persists for more than one hour. In that case, two distinct metabolic rates shall be used.

Note: For example, ~~***Example:***~~ a person who spends 30 minutes out of each hour "lifting/packing," 15 minutes "filing, standing," and 15 minutes "walking about" has an average metabolic rate of $0.50 \times 2.1 + 0.25 \times 1.4 + 0.25 \times 1.7 = 1.8$ met. However, a person who is engaged in "lifting/packing" for more than one hour and then "filing, standing" for more than one hour shall be treated as having two distinct metabolic rates per Section 5.2.1.1.

Modify Section 5.2.2.1.2 as follows.

5.2.2.1.2 Averaged clothing insulation (I_{cl}) shall not be used to represent multiple occupants ~~with significantly different clothing insulation~~ whose clothing insulation differs by more than 0.15 clo.

TABLE 5.3.1 Applicability of Methods for Determining Acceptable Thermal ~~Conditions~~Environments in Occupied Spaces

Average Air Speed, m/s (fpm)	Humidity Ratio	Met	Clo	Comfort Zone Method
<0.20 (40)	<0.012 kg·H_2O/kg dry air	1.0 to 1.3	0.5 to 1.0	Section 5.3.1, "Graphic Comfort Zone Method"
<0.20 (40)	All	1.0 to 2.0	0 to 1.5	Section 5.3.2, "Analytical Comfort Zone Method"
>0.20 (40)	All	1.0 to 2.0	0 to 1.5	Section 5.3.3, "Elevated Air Speed Comfort Zone Method"

Modify Section 5.2.2.2 as follows.

5.2.2.2 Insulation Determination. Use one or a combination of the following methods to determine clothing insulation (I_{cl}):

a. Use the data presented in Table 5.2.2.2A for the expected ensemble of each representative occupant.
b. Add or subtract the insulation (I_{clu}) of individual garments in Table 5.2.2.2B from the ensembles in Table 5.2.2.2A to determine the insulation of ensembles not listed.
c. Determine a complete clothing ensemble using the sum of the individual values listed for each item of clothing in the ensemble in Table 5.2.2.2B.
d. It is permitted, but not required, to adjust any of the ~~above~~ previous methods for seated occupants using Table 5.2.2.2C.
e. For moving occupants, it is permitted but not required to adjust any of the ~~above~~ previous methods using the following formula:

$$I_{cl,\ active} = I_{cl} \times (0.6 + 0.4/M)$$

$$1.2 \text{ met} < M < 2.0 \text{ met}$$

where M is the metabolic rate in mets and I_{cl} is the insulation without movement.

f. Interpolate between or extrapolate from the values given in Tables 5.2.2.2B and 5.2.2.2C.
g. Use Figure 5.2.2.2 to determine the clothing insulation (I_{cl}) of a representative occupant for a day as a function of outdoor air temperature at 06:00 a.m., $t_{a(out,6)}$.

~~Exception:~~ ~~The c~~Clothing insulation (I_{cl}) determined ~~according to~~ in accordance with Figure 5.2.2.2 ~~may be~~ is permitted but not required to be adjusted to ~~higher or lower values to~~ account for unique dress code or cultural norms using other methods in Section 5.2.2.2 or approved engineering methods.

h. Use measurement with thermal manikins or other approved engineering methods.

Modify Section 5.3 as follows.

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

Acceptable thermal ~~conditions~~ environments shall be determined using one of the three methods shown in Table 5.3.1 and any applicable requirements of Sections 5.3.4 and 5.3.5.

Note: *Average air speed* and *average air temperature* have precise definitions in this standard. See Section 3.0 for all defined terms.

Modify Section 5.3.3 as follows.

5.3.3 Elevated Air Speed Comfort Zone Method. Figure 5.3.3A represents two particular cases of the Elevated Air Speed Comfort Zone Method and shall be permitted as a method of compliance for the conditions specified on the figure. It is permissible to determine the ~~acceptable~~ operative temperature range by linear interpolation between the limits found for each zone in figure 5.3.3A.

Modify Section 5.3.3.3 as follows.

5.3.3.3 Average Air Speed (V_a) with Occupant Control. Section 5.3.3.4 does not apply when the occupants have control over average air speed (V_a) meeting one of the following criteria:

a. One means of control for every six occupants or less
b. One means of control for every 84 m^2 (900 ft^2) or less
c. In multi-occupant spaces where groups gather for shared activities, such as classrooms and conference rooms, at least one control shall be provided for each space, regardless of size. Multi-occupant spaces that ~~can be~~ are subdivided by moveable walls shall have one control for each space subdivision.

Modify Section 5.3.3.4 as follows. (Note: The text shown here reflects changes made by proposed Addendum d to the standard.)

5.3.3.4 Average Air Speed (V_a) without Occupant Control. If occupants do not have control over the local air speed meeting the requirements of Section 5.3.3.3, the following limits apply to the SET model and Figure 5.3.3A.

a. For operative temperatures (t_o) above 25.5°C (77.9°F), the upper limit to average air speed (V_a) shall be 0.8 m/s (160 fpm).
b. For operative temperatures (t_o) between 23.0°C and 25.5°C (73.4°F and 77.9°F), the upper limit to average air speed (V_a) shall follow an equal SET contour as described in Normative Appendix C. In Figure 5.3.3A this curve is shown between the dark and light shaded areas. It is ~~acceptable~~ permitted to ~~approximate the curve in Figure 5.3.3A in I-P and SI units by~~ determine the curve using the following equation:

$$V = 50.49 - 4.4047\ t_a + 0.096425(t_a)^2 \text{ (m/s, °C)}$$

$$V = 31375.7 - 857.295\ t_a + 5.86288(t_a)^2 \text{ (fpm, °F)}$$

c. For operative temperatures (t_o) below 23.0°C (73.4°F), the limit to average air speed (V_a) shall be 0.2 m/s (40 fpm).

Exceptions to Section 5.3.3.4(c):

1. Representative occupants with clothing insulation (I_{cl}) greater than 0.7 clo
2. Representative occupants with metabolic rates above 1.3 met

Note: These limits are shown by the light gray area in Figure 5.3.3A.

Modify Section 5.3.4.3 as follows. (Note that Section 5.3.4.3 was deleted in proposed Addendum d, so this proposed change is irrelevant if Addendum d is approved.)

5.3.4.3 Draft. At operative temperatures (t_o) below 22.5°C (72.5°F), average air speed (V_a) caused by the building, its fenestration, and its HVAC system shall not exceed 0.20 m/s (40 fpm). This limit does not require ~~consideration~~ determination of air movement produced by office equipment or occupants.

Exception: Higher average air speeds (V_a) that are permitted by Section 5.3.3

Modify Section 5.3.5.1 as follows.

5.3.5.1 Applicability. The fluctuation requirements of this section shall be met when they are not under the direct control of the individual occupant ~~(e.g., cycling from thermostatic control)~~.

Modify Section 5.3.5.3 as follows.

5.3.5.3 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 5.3.5.3.

Note: For example, the operative temperature ~~may~~ shall not change more than 2.2°C (4.0°F) during a 1.0 h period, and ~~it also may not change~~ more than 1.1°C (2.0°F) during any 0.25 h period within that 1.0 h period.

Modify Section 5.4.2.1.1 as follows.

5.4.2.1.1 It shall be based on no fewer than ~~seven~~ 7 and no more than 30 sequential days prior to the day in question.

Modify the first note in Section 6.2 as shown below. The remainder of Section 6.2 in unchanged.

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

Note: Some of the requirements in items (a) through (g) below ~~may not be~~ are not applicable to naturally conditioned buildings.

[…]

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