ANSI/ASHRAE Addendum a to
ANSI/ASHRAE Standard 55-2010

ASHRAE ADDENDA

Thermal Environmental Conditions for Human Occupancy

Approved by the ASHRAE Standards Committee on June 25, 2011; by the ASHRAE Board of Directors on June 29, 2011; and by the American National Standards Institute on June 30, 2011.

This addendum was approved by a Standing Standard Project Committee (SSPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the standard. The change submittal form, instructions, and deadlines may be obtained in electronic form from the ASHRAE Web site (www.ashrae.org) or in paper form from the Manager of Standards.

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ISSN 1041-2336

Approved American National Standard
ANSI
www.ansi.org

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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.

ASHRAE obtains consensus through participation of its national and international members, associated societies, and public review.

ASHRAE Standards are prepared by a Project Committee appointed specifically for the purpose of writing the Standard. The Project Committee Chair and Vice-Chair must be members of ASHRAE; while other committee members may or may not be ASHRAE members, all must be technically qualified in the subject area of the Standard. Every effort is made to balance the concerned interests on all Project Committees.

The Manager of Standards of ASHRAE should be contacted for:

a. interpretation of the contents of this Standard,
b. participation in the next review of the Standard,
c. offering constructive criticism for improving the Standard, or
d. permission to reprint portions of the Standard.

(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

This addendum makes two additions to the standard that clarify Figures 5.2.3.2 and 5.3 by providing numerical adjustment factors and equations. The addendum

- *adds equation for clothing and metabolic rate adjustments to Figure 5.2.3.2 that are equivalent to doing SET calculations to recreate the curves. These adjustments simplify calculations when the cooling effect of air movement is applied at clothing and metabolic rates other than those used for Figure 5.2.3.2.*
- *adds equations that are equivalent to the comfort boundaries of Figure 5.3.*

In addition, the SET model of the cooling effect of air movement is extended to Section 5.3, "Optional Method for Determining Acceptable Thermal Conditions in Naturally Conditioned Spaces." Additional air movement now extends the upper limit of the adaptive comfort zone in naturally ventilated buildings to warmer temperatures similar to the PMV/PPD model in Section 5.2.

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 a to 55-2010

[Add the following text to Section 5.2.3.3.2 as shown below:]

5.2.3.3.2 Without Local Control. Within the equal-heat-loss envelope, if occupants do not have control over the local air speed in their space, limits apply, as shown by the light gray area in Figure 5.2.3.2.

- For operative temperatures above 25.5°C (77.9°F), the upper limit to air speed shall be 0.8 m/s (160 fpm) for light, primarily sedentary office activities, such as in offices.
- For operative temperatures below 22.5°C (72.5°F), the limit shall be 0.15 m/s (30 ft/min) in order to avoid local cold discomfort due to draft.
- For operative temperatures between 22.5°C and 25.5°C (72.5°F and 77.9°F), the allowable speed shall follow the curve shown in Figure 5.2.3.2. This curve is an equal-SET curve for 0.6 clo and 1.1 met. It is acceptable to approximate the curve in SI and I-P units by the following equation:

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

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

The curves in Figure 5.2.3.2 shift toward the left or right as the clo or met level changes. An increase of 0.1 clo or 0.1 met corresponds to 0.8°C (1.4°F) or 0.5°C (0.9°F) operative temperature reduction; a decrease of 0.1 clo or 0.1 met corresponds to 0.8°C (1.4°F) or 0.5°C (0.9°F) operative temperature increase.

[Add the following text immediately following the third paragraph in Section 5.3 as shown below:]

5.3 Optional Method for Determining Acceptable Thermal Conditions in Naturally Conditioned Spaces.

[...]

For spaces that meet these criteria, it is acceptable to determine the allowable indoor operative temperatures from Figure 5.3. This figure includes two sets of operative temperature limits—one for 80% acceptability and one for 90% acceptability. The 80% acceptability limits are for typical applications and shall be used when other information is not available. It is acceptable to use the 90% acceptability limits when a higher standard of thermal comfort is desired. Figure 5.3 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.

The equations corresponding to the acceptable operative temperature ranges in Figure 5.3 are as follows:

Upper 80% acceptability limit (°C) = 0.31 (mean outdoor monthly air temperature) + 21.3
Upper 80% acceptability limit (°F) = 0.31 (mean outdoor monthly air temperature) + 60.5

Upper 90% acceptability limit (°C) = 0.31 (mean outdoor monthly air temperature) + 20.3
Upper 90% acceptability limit (°F) = 0.31 (mean outdoor monthly air temperature) + 58.7

Lower 80% acceptability limit (°C) = 0.31 (mean outdoor monthly air temperature) + 14.3
Lower 80% acceptability limit (°F) = 0.31 (mean outdoor monthly air temperature) + 47.9

Lower 90% acceptability limit (°C) = 0.31 (mean outdoor monthly air temperature) + 15.3
Lower 90% acceptability limit (°F) = 0.31 (mean outdoor monthly air temperature) + 49.7

[Add the following text and table to the last paragraph of Section 5.3 as shown below:]

5.3 Optional Method for Determining Acceptable Thermal Conditions in Naturally Conditioned Spaces.

[...]

No humidity or air-speed limits are required when this option is used.

Figure 5.3 includes the effects of people's indoor air speed adaptation in warm climates, up to 0.3 m/s (59 fpm) in operative temperatures 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 temperature limits in Figure 5.3 are increased by the corresponding Δt_0 in Table 5.3, which is based on equal SET values as illustrated in Section 5.2.3.2. 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 temperature limits in Figure 5.3 by a Δt_0 of 1.2°C (2.2°F). These adjustments to the upper 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 and 1.3 met).

TABLE 5.3 Increases in Acceptable Operative Temperature Limits (Δt_0) in the Adaptive Comfort Standard (Figure 5.3) Resulting from Increasing Air Speed above 0.3 m/s (59 fpm).

Air Speed 0.6 m/s (118 fpm)	Air Speed 0.9 m/s (177 fpm)	Air Speed 1.2 m/s (236 fpm)
1.2°C (2.2°F)	1.8°C (3.2°F)	2.2°C (4.0°F)

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.