



ASHRAE ADDENDA

Thermal Environmental Conditions for Human Occupancy

Approved by the ASHRAE Standards Committee on June 26, 2010; by the ASHRAE Board of Directors on June 30, 2010; and by the American National Standards Institute on July 1, 2010.

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ISSN 1041-2336

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and Air-Conditioning Engineers, Inc.**
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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.

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- 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
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In referring to this Standard or Guideline and in marking of equipment and in advertising, no claim shall be made, either stated or implied, that the product has been approved by ASHRAE.

(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 new Informative Appendix H provides a sample compliance form to supplement Section 6 of the standard. Section 6 was modified in Addendum e of Standard 55-2004. Section 6 of the standard and this sample compliance form document design compliance.

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

Addendum i to Standard 55-2004

Add a new informative appendix as follows:

(This appendix 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.)

INFORMATIVE APPENDIX H— SAMPLE COMPLIANCE DOCUMENTATION

[forms to add are on the following pages]

SAMPLE COMPLIANCE DOCUMENTATION TEMPLATE

Based on Standard 55-2004 including Addenda A through G

COMPLETE SECTION ONE FOR ALL PROJECTS

SECTION ONE

Assumptions for personal factors in each space type category & season

Space Type (i.e., Office, Lobby, Gym)	Clothing Level (CLO)				Metabolic Rate (MET)
	Spring	Summer	Fall	Winter	

COMPLETE SECTION TWO FOR PROJECTS USING THE PMV/PPD METHOD

SECTION TWO

Weather data used for design calculations

Weather design conditions used for peak load calculations (0.5%, 1%, etc.)
 Cooling Heating

Hours per typical year that outdoor temperature exceeds design conditions
 Cooling Heating

Space Type (i.e., Office, Lobby, Gym)	Design Operative Temperature (degF)*				Maximum Design Humidity (RH)				Design Air Speed (ft/min)				
	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	
Cooling Mode													
Heating Mode													

* Operative temperature includes radiant effects. See Standard 55.

Verify that the combinations of assumed personal factors, operative temperature, air speed, and humidity above are predicted to limit the percentage of dissatisfied people to less than 10% per Standard 55. (Include supporting documentation with PMV/PPD calculation, ASHRAE comfort tool results, and/or psychrometric comfort zone chart from Standard 55).

Cooling Effect of Air Movement

When air speed is used to offset increased temperature using Figure 5.2.3.1 or the SET method (Figure 5.2.3.2) the appropriate section below shall be completed.

Figure 5.2.3.1 method

Verify that air speed is less than 0.8m/s (160 ft/min) and CLO is less than 0.7

Figure 5.2.3.2 method

Verify that air speeds are within specified limits of Figure 5.2.3.2 when occupants do not have local control over air speed.

Verify that air speeds are within specified limits of Figure 5.2.3.2 when occupants have local control and that there are separate controls for every 84 sq. meters (900 sq.ft.)

Local Discomfort Effects

Verify that local discomfort effects have been considered and are not likely to exceed Standard 55 limits. When local discomfort effects are likely to occur, verify that calculations were performed to demonstrate that local discomfort effects are predicted to result in less than 10% dissatisfied occupants.

<u>Local Discomfort Effect</u>	Not Likely	Calculations Performed
Radiant Temperature Asymmetry	<input type="text"/>	<input type="text"/>
Vertical Air Temperature Difference	<input type="text"/>	<input type="text"/>
Floor Surface Temperature	<input type="text"/>	<input type="text"/>
Draft	<input type="text"/>	<input type="text"/>

COMPLETE SECTION THREE FOR SPACES USING THE ADAPTIVE METHOD

SECTION THREE

Standard 55.

- a) The spaces have operable windows open to the outdoors readily adjustable by occupants.
- b) No mechanical cooling systems serve the space.
- c) any heating system is not in operation when this method is used, d) Metabolic rates are expected to be from 1.0 to 1.3 MET.

Weather data used for mean monthly outdoor temperature calculations

Verify that mean monthly outdoor temperature is within the limits of Figure 5.3 for all months where the adaptive method is used.

Verify that operative temperature is predicted to be within the 80% acceptability limits on Figure 5.3 from ASHRAE 55. (Provide supporting documentation with inputs and results of calculations or simulations. Include mean monthly outdoor conditions and worst case predicted indoor conditions for each month. Show predicted worst case indoor conditions for each month on Figure 5.3 of ASHRAE 55.)

(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 updates references in the Standard to reflect updated publications since 2004.

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

Addendum k to Standard 55-2004

Revise the second paragraph of Section 5.2.1 to update the reference to the ASHRAE Handbook—Fundamentals as follows:

5.2.1 Operative Temperature.

This section describes methods that may be used to determine temperature limits for the comfort zone. Section 5.2.1.1 uses a simplified graphical method for determining the comfort zone that may be used for many typical applications. Section 5.2.1.2 uses a computer program based on a heat balance model to determine the comfort zone for a wider range of applications. For a given set of conditions, the results from the two methods are consistent, and either method may be used as long as the criteria outlined in the respective section are met. See Appendix C and the ~~2009/2004~~ ASHRAE Handbook—Fundamentals,³ Chapter 98, for procedures to calculate operative temperature. Dry-bulb temperature may be used as a proxy for operative temperature under certain conditions described in Appendix C.

Revise the fifth, sixth, and eighth paragraphs of Section 5.4 to update the reference to the ASHRAE Handbook—Fundamentals as follows:

5.4 Description of Thermal Environmental Variables

.....

Mean radiant temperature is defined as the temperature of a uniform, black enclosure that exchanges the same amount of thermal radiation with the occupant as the actual enclosure. It is a single value for the entire body and may be considered a spatial average of the temperature of surfaces surrounding the occupant weighted by their view factors with respect to the occupant. See Chapter 98 in the ~~2009/2004~~ ASHRAE Handbook—Fundamentals³ for a more complete description of mean radiant temperature. For the purposes of Section 5, mean radiant temperature is also a time-averaged value. As a minimum, the temporal average is a three-minute average with at least 18 equally spaced points in time. However, the period

may extend up to 15 minutes to average cyclic fluctuations if necessary.

Operative temperature is the average of the air temperature and the mean radiant temperature weighted, respectively, by the convective heat transfer coefficient and the linearized radiant heat transfer coefficient for the occupant. See Chapter 98 in the ~~2009/2004~~ ASHRAE Handbook—Fundamentals³ for a more complete description of operative temperature. For occupants engaged in near sedentary physical activity (with metabolic rates between 1.0 met and 1.3 met), not in direct sunlight, and not exposed to air velocities greater than 0.20 m/s (40 fpm), the relationship can be approximated with acceptable accuracy by

.....

The horizontal radiant asymmetry is the maximum difference between opposite plane radiant temperatures for all horizontal directions. The radiant asymmetry is determined at waist level—0.6 m (24 in.) for a seated occupant and 1.1 m (43 in.) for a standing occupant. Time averaging for radiant asymmetry is the same as for mean radiant temperature. See Chapter 98 in the ~~2009/2004~~ ASHRAE Handbook—Fundamentals³ for a more complete description of plane radiant temperature and radiant asymmetry.

Revise item number 1 in Section 6.2 as follows:

(Section 6 was completely deleted and replaced with a new Section 6 through the publication of Addendum e to 55-2004. This addendum is available for free download from the ASHRAE Web site at <http://www.ashrae.org/technology/page/132>.) The rest of Section 6 remains unchanged.

6.2 Documentation.

1. The design operative temperature and humidity, including any tolerance or range, the design outdoor conditions (see ~~2009~~ ASHRAE Handbook—Fundamentals,³ Chapter 1427, “Climatic Design Information”), and total indoor loads, shall be stated. The design exceedance level (the number of hours per year where conditions exceed Section 5 criteria) shall be documented based on the design conditions used in design. At a minimum, the hours of each seasonal exceedance associated with the outdoor weather percent design conditions (see ~~2009~~ ASHRAE Handbook—Fundamentals,³ Chapter 1427) used in design shall be stated. In complex and/or passive systems, hours of exceedance may need to be calculated using a dynamic thermal simulation that predicts indoor conditions for every hour of the year.

Revise Section 7.1 as follows:

7.1 Measuring Device Criteria

The measuring instrumentation used shall meet the requirements for measuring range and accuracy given in ASHRAE Standard 70-~~1991~~⁵ or 113-~~1990~~⁶ or in ISO 7726,¹ and the referenced source shall be so identified.

Revise the fourth paragraph of Section 7.6.2.2 as follows:

Where variables are going to be trended, successful comfort control shall be a function of steady-state performance. Steady state shall require that the trended variable remain within a specified range without cycling. Cycling is defined as fluctuation over 50% of the permitted range every 15 minutes or more frequently. This verification shall include trending variables for at least one occupied cycle during each seasonal condition. When thermal conditions in the occupied zone have a high sensitivity to time of day and weather conditions, the measurement shall be made such that the high and low extremes of the thermal parameters are determined. ASHRAE Standard 113-1990⁶ offers a procedure for determining air speed and temperature variations in building spaces and provides additional guidance for the measurement of mechanical equipment parameters.

Revise Section 8 as follows:

8. REFERENCES

1. ISO 7726:1998, *Ergonomics of the Thermal Environment—Instruments for Measuring Physical Quantities*.
2. ISO 7730:2005~~1994~~, *Ergonomics of the Thermal Environment - Analytical Determination and Interpretation of Thermal Comfort using Calculation of the PMV and PPD Indices and Local Thermal Comfort Criteria*~~Moderate thermal environments—Determination of the PMV and PPD indices and specification of the conditions for thermal comfort~~.
3. ~~2009~~~~2001~~ ASHRAE Handbook—Fundamentals.
4. ASHRAE Thermal Comfort Tool CD (ASHRAE Item Code 94030).
5. ASHRAE Standard 70-~~2006~~~~1991~~, *Method of Testing for Rating the Performance of Air Outlets and Inlets*.
6. ASHRAE Standard 113-~~2009~~~~1990~~, *Method of Testing for Room Air Diffusion*.

Revise Normative Appendix A as follows:

(The rest of appendix remains unchanged)

Use of Metabolic Rate Data

These data are reproduced from Chapter 98 of the ~~2009~~~~2001~~ ASHRAE Handbook—Fundamentals.³ The values in the table represent typical metabolic rates per unit of skin surface area for an average adult (DuBois area = 1.8 m², or 19.6 ft²) for activities performed continuously. This handbook chapter provides additional information for estimating and measuring activity levels. General guidelines for the use of these data follow.

Revise Normative Appendix B as follows:

(The rest of appendix remains unchanged)

NORMATIVE APPENDIX B— CLOTHING INSULATION

The amount of thermal insulation worn by a person has a substantial impact on thermal comfort and is an important variable in applying this standard. Clothing insulation is expressed in a number of ways. In this standard, the clothing insulation of an ensemble expressed as a clo-value (I_{cl}) is used. Users not familiar with clothing insulation terminology are referred to Chapter 98, ~~2009~~~~2001~~ ASHRAE Handbook—Fundamentals,² for more information.

Revise Footnote a of Tables B1 and B2 as follows:

(The rest of the tables remain unchanged)

^a Data are from Chapter 98 in the ~~2009~~~~2001~~ ASHRAE Handbook—Fundamentals.³

Revise Informative Appendix F as follows:

(The rest of appendix remains unchanged)

INFORMATIVE APPENDIX F— BIBLIOGRAPHY

ASHRAE Standard 70-~~2006~~~~1991~~, *Method of Testing for Rating the Performance of Air Outlets and Inlets*.
ASHRAE Standard 113-~~2009~~~~1990~~, *Method of Testing for Room Air Diffusion*.
~~2009~~ ASHRAE Handbook—~~2001~~ Fundamentals.

**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.