ADDENDA

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

Thermal Environmental Conditions for Human Occupancy

Approved by the ASHRAE Standards Committee on February 15, 2013; by the ASHRAE Board of Directors on February 26, 2013; and by the American National Standards Institute on February 27, 2013.

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FOREWORD

This addendum clarifies the normative requirements for determining metabolic rates for representative occupants and moves these normative requirements to the body of the Standard. It adds a new informative appendix containing similar material that was previously in Normative Appendix A.

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 g to Standard 55-2010

Revise the note in Section 5.1 as follows. (Reference Addenda b and d to Standard 55-2010 published for free on the ASHRAE website at www.ashrae.org/standards-research--technology/standards-addenda.)

…

Note: Complete descriptions of the six factors are presented in Section 5.4 ~~and Normative Appendices A and B~~. The first two are characteristics of the occupant and the remaining four are conditions of the thermal environment.

…

Delete the notes from Sections 5.2.1.1, 5.2.1.2, and 5.3.1.2 as follows. (Reference Addenda b and d to Standard 55-2010 published for free on the ASHRAE website at www.ashrae.org/standards-research--technology/standards-addenda.)

5.2.1.1 Graphic Comfort Zone Method for Typical Indoor Environments. Use of this method shall be limited to representative occupants with metabolic rates between 1.0 and 1.3 met, and clothing insulation between 0.5 and 1.0 clo, in spaces with air speeds less than 0.2 m/s (40 ft/min).

(~~*Note:* See Normative Appendix A for estimation of metabolic rates and Normative Appendix B for estimation of clothing insulation. Most office spaces fall within these limitations.)~~

...

5.2.1.2 Computer Model Method for General Indoor Application. It is permissible to apply the method in this section to spaces where the occupants have activity levels that result in average metabolic rates between 1.0 and 2.0 met and where clothing is worn that provides 1.5 clo or less of thermal insulation. ~~See Normative Appendix A for estimation of metabolic rates and Normative Appendix B for estimation of clothing insulation.~~

…

5.3.1.2. Occupants are engaged in near-sedentary physical activities, with metabolic rates ranging from 1.0 to 1.3 met. ~~See Normative Appendix A for estimation of metabolic rates.~~

…

Add a new Section 5.2 and renumber the existing Section 5.2 and subsequent sections, figures, and tables.

5.2 Method for Determining Occupant Characteristics

5.2.1 Metabolic Rate

5.2.1.1 Rate for Each Representative Occupant. For each representative occupant, determine the metabolic rate associated with the occupant's activities. Activities of several occupants with significantly different activities shall *not* be averaged to find a single, average metabolic rate.

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.

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

a. 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.

b. Interpolate between or extrapolate from the values given in Table 5.2.1.2.

c. Use estimation and/or measurement methods described in Chapter 9 of *ASHRAE Handbook—Fundamentals*[3].

d. Use other approved engineering or physiological methods.

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 an activity persists for more than one hour. In that case, two distinct metabolic rates shall be used.

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.

5.2.1.4 High Metabolic Rates. This standard does not apply to occupants whose time-averaged metabolic rate exceeds 2.0 met.

TABLE 5.2.1.2 Metabolic Rates for Typical Tasks

Activity	Metabolic Rate		
	Met Units	W/m^2	(Btu/h·ft^2)
Resting			
Sleeping	0.7	40	(13)
Reclining	0.8	45	(15)
Seated, quiet	1.0	60	(18)
Standing, relaxed	1.2	70	(22)
Walking (on level surface)			
0.9 m/s, 3.2 km/h, 2.0 mph	2.0	115	(37)
1.2 m/s, 4.3 km/h, 2.7 mph	2.6	150	(48)
1.8 m/s, 6.8 km/h, 4.2 mph	3.8	220	(70)
Office Activities			
Reading, seated	1.0	55	(18)
Writing	1.0	60	(18)
Typing	1.1	65	(20)
Filing, seated	1.2	70	(22)
Filing, standing	1.4	80	(26)
Walking about	1.7	100	(31)
Lifting/packing	2.1	120	(39)
Driving/Flying			
Automobile	1.0–2.0	60–115	(18–37)
Aircraft, routine	1.2	70	(22)
Aircraft, instrument landing	1.8	105	(33)
Aircraft, combat	2.4	140	(44)
Heavy vehicle	3.2	185	(59)
Miscellaneous Occupational Activities			
Cooking	1.6–2.0	95–115	(29–37)
House cleaning	2.0–3.4	115–200	(37–63)
Seated, heavy limb movement	2.2	130	(41)
Machine work			
sawing (table saw)	1.8	105	(33)
light (electrical industry)	2.0–2.4	115–140	(37–44)
heavy	4.0	235	(74)
Handling 50 kg (100 lb) bags	4.0	235	(74)
Pick and shovel work	4.0–4.8	235–280	(74–88)
Miscellaneous Leisure Activities			
Dancing, social	2.4–4.4	140–255	(44–81)
Calisthenics/exercise	3.0–4.0	175–235	(55–74)
Tennis, single	3.6–4.0	210–270	(66–74)
Basketball	5.0–7.6	290–440	(90–140)
Wrestling, competitive	7.0–8.7	410–505	(130–160)

Modify Section 6.2 as follows.

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 1–4 below may not be applicable to naturally conditioned buildings.

1. The design operative temperature and humidity (including any tolerance or range), the design outdoor conditions (see 2009 *ASHRAE Handbook—Fundamentals*,[3] Chapter 14, “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 14) 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.
2. Values assumed for comfort parameters used in the calculation of design temperatures, including clothing, metabolic rate, and indoor-air speed, shall be clearly stated. The clo level for the clothing of occupants intended to be satisfied shall be documented, including different clo levels for different seasons. The metabolic rate of occupants intended to be satisfied shall be documented. Where different clo levels or metabolic rates are anticipated in different spaces or at different times, these assumptions shall be documented. If an acceptable level of comfort is not being provided to any representative occupants, this shall be stated in the design documentation. Where Table 5.2.1.2 gives a range, record the basis for selecting a single value within that range.
3. Local discomfort effects are difficult to calculate due to limitations in thermal modeling tools, but can be estimated with simplified assumptions. Local discomfort shall be addressed by, at a minimum, a narrative explanation of why an effect is not likely to exceed Section 5 limits. When a design has asymmetric thermal conditions (e.g., radiant heating/cooling, areas of glazing that are above 50% window-to-wall ratio, additional air movement, stratified displacement cooling), a calculation of related local discomfort effects shall be included. At a minimum, documentation shall identify the design condition analyzed for each local discomfort effect and any simplifying assumptions used in the calculation.
4. The system input or output capacities necessary to attain the design indoor thermal comfort conditions stated in Item 1 above at design outdoor conditions shall be stated.

Note: See Informative Appendix G for sample compliance documentation.

Delete the existing Normative Appendix A and replace it with the following new Informative Appendix A. Also update the table of contents to reflect this change.

(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 A— USE OF METABOLIC RATE DATA

The data presented in Table 5.2.1.2 are reproduced from Chapter 9 of the 2009 *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 m^2, or 19.6 ft^2) 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.

Every activity that may be of interest is not included in this table. Users of this standard should use their judgment to match the activities being considered to comparable activities in the table. Some of the data in this table are reported as a range and some as a single value. The format for a given entry is based on the original data source and is *not* an indication of when a range of values should or should not be utilized. For all activities except sedentary activities, the metabolic rate for a given activity is likely to have a substantial range of variation that depends on the individual performing the task and the circumstances under which the task is performed.

It is permissible to use a time-weighted average metabolic rate for individuals with activities that vary over a period of one hour or less. For example, a person who typically 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. Such averaging should not be applied when the period of variation is greater than one hour. For example, a person who is engaged in “lifting/packing” for more than one hour and then “filing, standing” for more than one hour should be treated as having two distinct metabolic rates.

As metabolic rates increase above 1.0 met, the evaporation of sweat becomes an increasingly important factor for thermal comfort. The PMV method does not fully account for this factor, and this standard should not be applied to situations where the time-averaged metabolic rate is above 2.0 met. ***Note:*** Rest breaks (scheduled or hidden) or other operational factors (get parts, move products, etc.) combine to limit time-weighted metabolic rates to about 2.0 met in most applications.

Time averaging of metabolic rates only applies to an individual. The metabolic rates associated with the activities of various individuals in a space may *not* be averaged to find a single, average metabolic rate to be applied to that space. The range of activities of different individuals in the space, and the environmental conditions required for those activities, should be considered in applying this standard. For 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 should be considered separately in determining the conditions required for comfort. In some situations, it will not be possible to provide an acceptable level or the same level of comfort to all disparate groups of occupants (e.g., restaurant customers and servers).

The metabolic rates in Table 5.2.1.2 were determined when the subjects' thermal sensation was close to neutral. It is not yet known the extent to which people may modify their metabolic rate to decrease warm discomfort.

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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