BSR/ASHRAE Addendum c
to ANSI/ASHRAE Standard 55-2023

Public Review Draft

Proposed Addendum c to Standard 55-2023, Thermal Environmental Conditions for Human Occupancy

First Public Review (2026)
(Draft shows Proposed Changes to Current Standard)

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FOREWORD

The current model for predicting the percentage dissatisfied with ankle draft (PPD_{AD}) was developed under summer, low clothing insulation conditions to support the design and comfort evaluation of underfloor air distribution and displacement ventilation systems. Although the dataset used to develop the existing model included some covered-ankle samples, the original model could not properly consider the effect of clothing. New data has been collected and a more comprehensive dataset is available now. When occupants wear long trousers and socks, direct application of the existing model overestimate the risk of ankle draft discomfort. This overestimation has important implications, for example, in winter window downdraft scenarios, such overestimation may lead to unnecessary installation of perimeter heating systems. This addendum proposes to modify the current ankle draft risk model by distinguishing between exposed and covered ankle condition, providing a more accurate ankle draft risk evaluation under different clothing conditions. This will help support more energy-efficient HVAC design without compromising occupant thermal comfort.

[Note to Reviewers: This addendum makes proposed changes to the current standard. These changes are indicated in the text by underlining (for additions) and ~~strikethrough~~ (for deletions) except where the reviewer instructions specifically describe some other means of showing the changes. Only these changes to the current standard are open for review and comment at this time. Additional material is provided for context only and is not open for comment except as it relates to the proposed changes.]

Addendum c to 55-2023

Edit section "5.3.5" as follows:

5.3.5.1 Applicability

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

~~a. Have clothing insulation I_{cl} less than 0.7~~

~~b.~~ are engaged in physical activity with metabolic rates below 1.3 met.

…..

5.3.5.3 Ankle Air Speed

Ankles shall be considered covered when the skin in the ankle region is fully covered by clothing, footwear, or a combination of clothing and footwear. Ankles shall be considered uncovered when any portion of the skin in the ankle region is not covered by clothing, footwear, or a combination of the two. Based on whether the ankles are covered or uncovered, ~~Air~~ air speed at 0.1 m (4 in.) above the floor shall be less than the value resulting from the formula below, or in the shaded region of Figure 5-7:

~~$V_{ankle} < 0.35TS + 0.39$ (V_{ankle} in m/s)~~

~~$V_{ankle} < 70.7TS + 79.6$ (V_{ankle} in fpm)~~

For the ankle-uncovered condition:

$$V_{ankle} < 0.40TS + 0.31 \quad (V_{ankle} \text{ in m/s})$$

$$V_{ankle} < 79.8TS + 61.7 \quad (V_{ankle} \text{ in fpm})$$

For the ankle-covered condition:

$$V_{ankle} < 0.52TS + 0.98 \qquad (V_{ankle} \text{ in m/s})$$

$$V_{ankle} < 102.1TS + 191.0 \qquad (V_{ankle} \text{ in fpm})$$

where

V_{ankle} = air speed at 0.1 m (4 in.) above the floor

TS = whole-body thermal sensation; equal to PMV calculated using the input air temperature and speed averaged over two heights: 0.6 m (24 in.) and 1.1 m (43 in.) for seated occupants and 1.1 m (43 in.) and 1.7 m (67 in.) for standing occupants.

Exception to 5.3.5.3: The requirement in this section does not apply when using elevated air speed in Section 5.3.4.

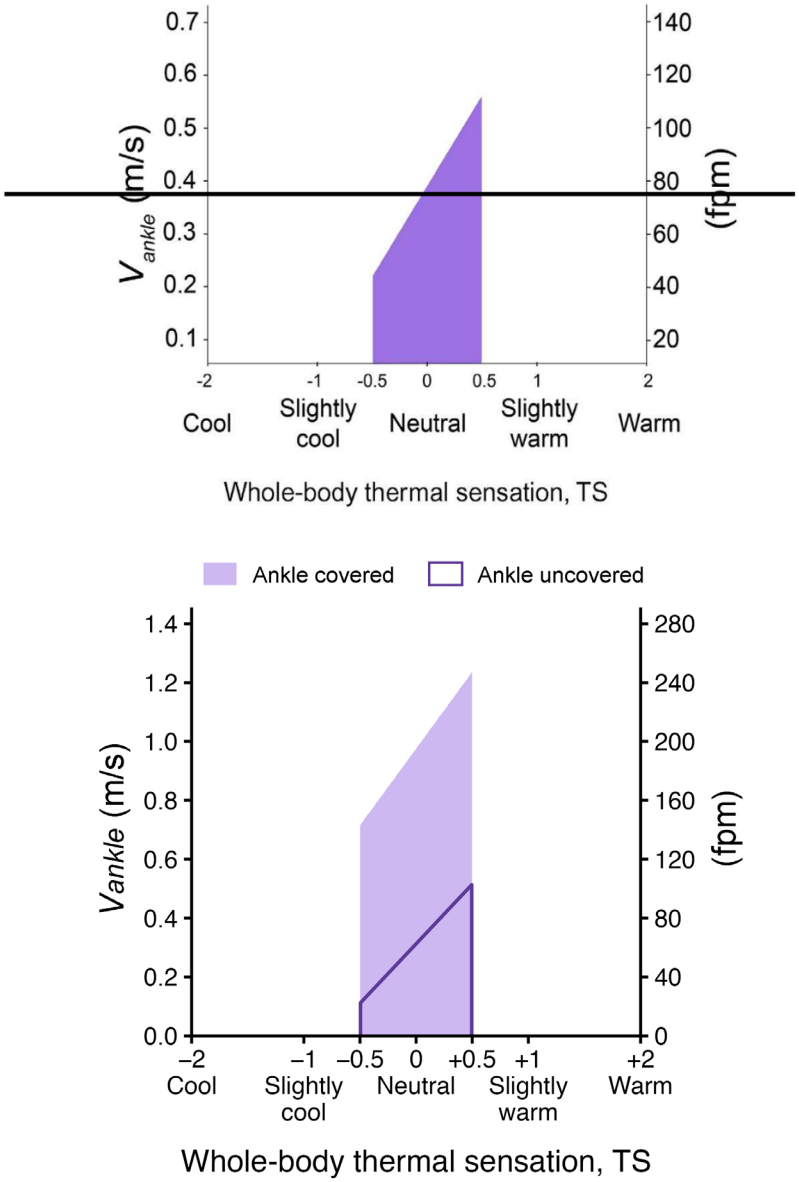


Figure 5-7 Air speed limits at 0.1 m (4 in.) above the floor as a function of whole-body thermal sensation.

Edit Informative appendix I, section "I3" as follows:

…..

The maximum air speed at the ankle level is deduced from the predicted percentage of dissatisfied with ankle draft PPD_{AD}. PPD_{AD} is an index that establishes a quantitative prediction of the percentage of thermally dissatisfied people with the draft at ankle level. Because clothing coverage at the ankle can affect local thermal sensitivity, separate PPD_{AD} are used for covered and uncovered ankle conditions. ~~PPD_{AD}~~ It is calculated according to the following formula or is deduced from Figure I-2:

~~$$PPD_{AD} = \frac{\exp(-2.58+3.05V-1.06TS)}{1+\exp(-2.58+3.05V-1.06TS)} \quad (V_{ankle} \text{ in m/s})$$~~

~~$$PPD_{AD} = \frac{\exp(-2.58+0.015V-1.06TS)}{1+\exp(-2.58+0.015V-1.06TS)} \quad (V_{ankle} \text{ in m/s})$$~~

For the ankle-uncovered condition:

$$PPD_{AD} = \frac{\exp(-2.09+2.25V-0.91TS)}{1+\exp(-2.09+2.25V-0.91TS)} \quad (V_{ankle} \text{ in m/s})$$

$$PPD_{AD} = \frac{\exp(-2.09+0.011V-0.91TS)}{1+\exp(-2.09+0.011V-0.91TS)} \quad (V_{ankle} \text{ in fpm})$$

For the ankle-covered condition:

$$PPD_{AD} = \frac{\exp(-3.22+1.88V-0.98TS)}{1+\exp(-3.22+1.88V-0.98TS)} \quad (V_{ankle} \text{ in m/s})$$

$$PPD_{AD} = \frac{\exp(-3.22+0.0096V-0.98TS)}{1+\exp(-3.22+0.0096V-0.98TS)} \quad (V_{ankle} \text{ in fpm})$$

where

PPD_{AD} = air speed at 0.1 m (4 in.) above the floor

TS = whole-body thermal sensation; equal to PMV calculated using the input air temperature and speed averaged over two heights: 0.6 m (24 in.) and 1.1 m (43 in.) for seated occupants and 1.1 m (43 in.) and 1.7 m (67 in.) for standing occupants.

V_{ankle} = air speed at 0.1 m (4 in.) above the floor

The air speed limits at 0.1 m (4 in.) in Section 5.3.5.3 are derived by setting PPD_{AD} equal to 20%. The PPD_{AD} provides a simple tool to estimate the draft at ankles and lower legs. In this model, the whole-body thermal sensation can be approximated using the PMV with the input air temperature, clothing level, and air speed averaged over two heights and not three as in the rest of the standard. The two heights are 0.6 m (24 in.) and 1.1 m (43 in.) for seated occupants and 1.1 m (43 in.) and 1.7 m (67 in.) for standing occupants. The clothing assemble is also used to determine whether the ankles are covered. Ankles are considered covered when the skin of the ankle region is fully shielded from the surrounding air by clothing, footwear, or their combination. Examples include long pants extending to the footwear, socks extending above the footwear opening, and boots or other footwear that enclose the ankle region. Ankles are considered uncovered when any portion of ankle skin is directly exposed to the surrounding air, including barefoot conditions, open footwear such as sandals, slippers, or flip-flops, low-cut socks that leave the ankle uncovered, or other clothing configurations that expose the ankle skin.

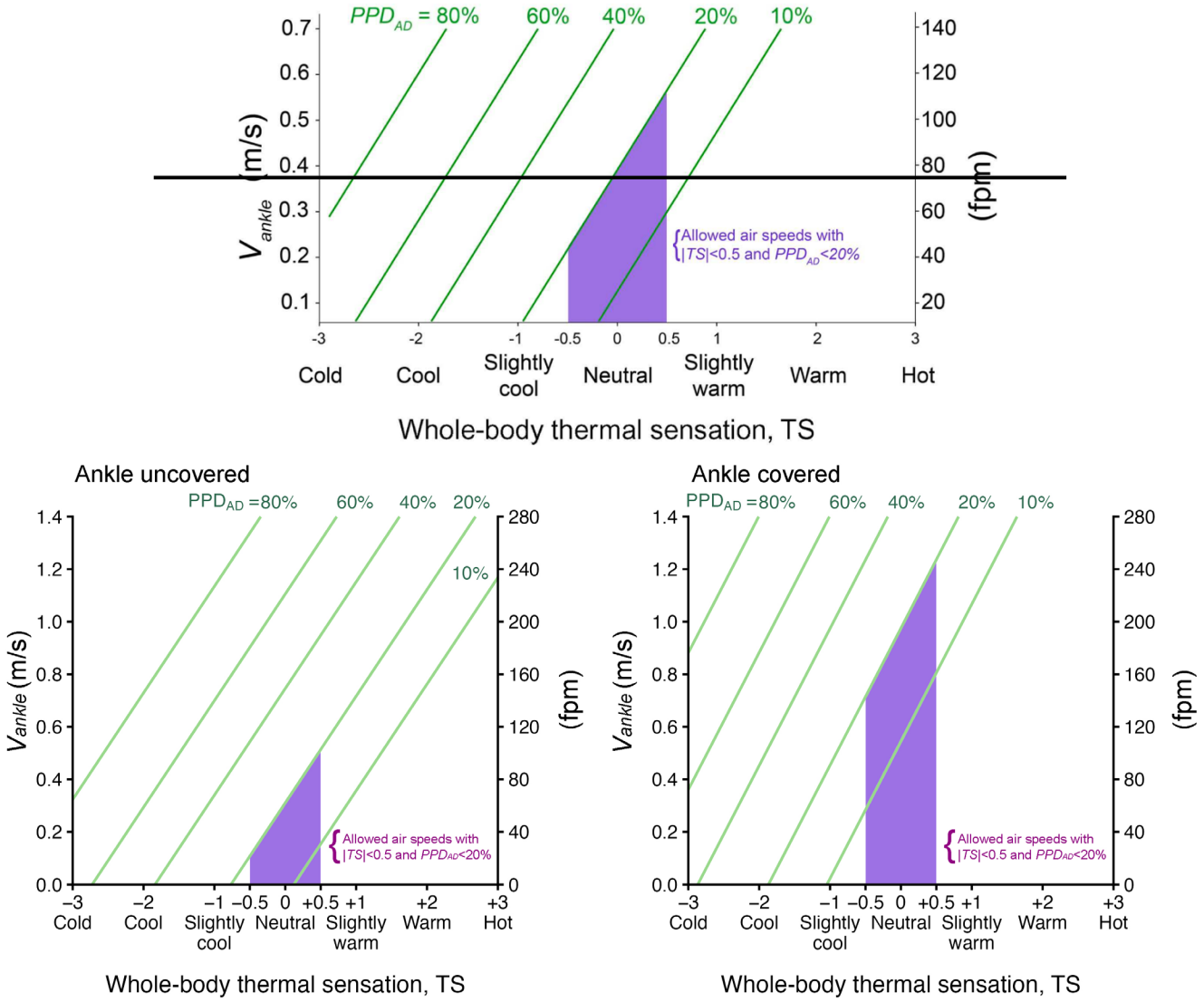


Figure I-2 Air speed limits at 0.1 m (4 in.) above the floor as a function of whole-body thermal sensation and the predicted percentage of dissatisfied with ankle draft (PPD_{AD})

Add to Informative appendix M, references related to sample size as follows:

T. Kramer, J. Lyu, S. Schiavon 2026. Ankle draft risk model under winter clothing conditions, *Building and Environment,* Under Review.