

ANSI/ASHRAE Addendum g to  
ANSI/ASHRAE Standard 90.2-2001



# ASHRAE<sup>®</sup> STANDARD

## Energy-Efficient Design of Low-Rise Residential Buildings

Approved by the ASHRAE Standards Committee January 24, 2004; by the ASHRAE Board of Directors January 29, 2004; and by the American National Standards Institute February 25, 2004.

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**FOREWORD**

This proposed addendum deletes all provisions, tables, figures, and references that are solely associated with manufactured housing. The basis for this recommendation is as follows:

- The energy regulations governing manufactured housing are under the control of the federal government, specifically the U.S. Department of Housing and Urban Development (The HUD Code, 24 CFR 3280).
- Letters (dated January 21, 2000) from the Manufactured Housing Institute’s Mr. Frank Walter (VP Technical Affairs) to Jonathan Humble (Chair-SSPC 90.2 Envelope Subcommittee) stating that MHI recognizes only the federally mandated HUD Code and that the MHI recommendation to SSPC 90.2 is to remove the manufacturing housing requirements from Standard 90.2.
- Recognition that Standard 90.2-2001 is less stringent than the HUD Code for the following locations: Arizona, Arkansas, California, New Mexico, North Carolina, and Tennessee.

Additions are shown in this addendum by underlining; deletions are shown by strikethrough.

**Addendum g to 90.2-2001**

(Revise the scope in Section 2 as shown.)

**2. SCOPE**

2.1 This standard provides minimum energy efficiency requirements for the design and construction of

- (a) new residential dwelling units and their systems, and
- (b) where explicitly specified,
  1. new portions of residential dwelling units and their systems, and
  2. new systems and equipment in existing dwelling units.

**Note:** There are no requirements in this standard that apply to new portions of residential dwelling units and their systems, nor to new systems and equipment in existing dwelling units.

For the purposes of this standard, “residential dwelling units” include single-family houses, multi-family structures (of three stories or fewer above grade), ~~manufactured houses (mobile homes), and manufactured houses (and modular houses).~~ This standard does not include “transient” housing such as hotels, motels, nursing homes, jails, and barracks, or manufactured housing.

(Delete or revise the following definitions in Section 3 as shown.)

**3.3 Definitions**

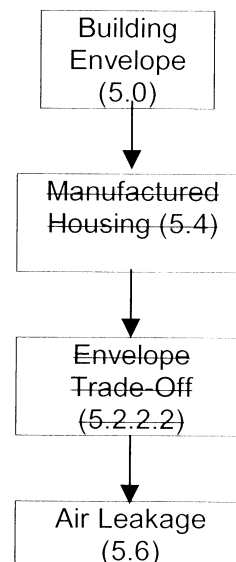
~~**length of manufactured (mobile) house:** largest overall length in the traveling mode, including cabinets and other projections that contain interior space. Length does not include bay windows, roof projections, overhangs, or eaves under which there is no interior space, nor does it include drawbars, couplings, or hitches.~~

~~**manufactured house (mobile home):** a structure, transportable in one or more sections, which, in the traveling mode, is 8 ft or more in width or 40 ft or more in length or, when erected on site, is 320 ft<sup>2</sup> or more, is built on a permanent chassis and designed to be used as a living unit with or without a permanent foundation when connected to the required utilities, and includes the plumbing, heating, air conditioning, and electrical systems contained therein. Calculations used to determine the number of square feet in a structure shall be based on the structure’s exterior dimensions measured at the largest horizontal projections when erected on site. These dimensions shall include all expandable rooms, cabinets, and other projections<sup>1</sup> containing interior space, but do not include bay windows.~~

~~**single-family house:** building containing one or two living units or a townhouse, including a manufactured house (modular house) but not a manufactured house (mobile home).~~

~~**width of manufactured (mobile) house:** largest overall width in the traveling mode, including cabinets and other projections that contain interior space. Width does not include bay windows, roof projections, overhangs, or eaves under which there is no interior space.~~

(Revise Figure 4-1 by deleting the rectangles containing “Manufactured Housing [5.4]” and “Envelope Trade-Off [5.2.2.2],” the words in these rectangles, and the arrows associated with these rectangles. The rectangles that should be deleted are shown in the following partial flow chart of Figure 4-1.)



(Delete Section 4.4.1.1.2 and renumber Sections 4.4.1.1.3 through 4.4.1.1.8 accordingly.)

~~4.4.1.1.2 Compliance for manufactured houses (mobile homes) is achieved when the requirements of 5.4 are met. These requirements consist of an overall U factor for the entire envelope.~~

(Delete Section 5.2.2.2 and its subsections, Sections 5.2.2.2.1 and 5.2.2.2.2, and renumber the preceding sections of Section 5.2.2 accordingly. Also renumber Equations 5-8 through 5-12 and references to them because Equations 5-6 and 5-7 are contained in the these deleted sections.)

~~5.2.2.2 Manufactured Houses (Mobile Homes)~~

~~5.2.2.2.1 Overall Thermal Transmittance. The overall thermal transmittance (U<sub>o</sub>) of the entire envelope is the variable used to set the requirements and demonstrate compliance. Acceptable combinations of envelope components that meet the U<sub>o</sub> requirements shall be calculated using Equation 5-6.~~

(Note: Delete Equation 5.6, which is not shown here.)  
where

- ~~U<sub>o</sub> = overall thermal transmittance of the entire envelope, Btu/h-ft<sup>2</sup>·°F;~~
- ~~U<sub>ceiling</sub> × A<sub>ceiling</sub> = product of the thermal transmittance of the ceiling envelope component multiplied by the area of the ceiling envelope component, Btu/h·°F;~~
- ~~U<sub>wall</sub> × A<sub>wall</sub> = product of the thermal transmittance of the wall envelope component multiplied by the area of the wall envelope component, Btu/h·°F;~~
- ~~U<sub>fen</sub> × A<sub>fen</sub> = product of the thermal transmittance of the fenestration envelope component multiplied by the area of the fenestration envelope component Btu/h·°F;~~
- ~~U<sub>door</sub> × A<sub>door</sub> = product of the thermal transmittance of the door envelope component multiplied by the area of the door envelope component, Btu/h·°F;~~
- ~~U<sub>floor</sub> × A<sub>floor</sub> = product of the thermal transmittance of the floor envelope component multiplied by the area of the floor envelope component, Btu/h·°F;~~
- ~~A<sub>ceiling</sub> = area of the ceiling envelope component based on the exterior dimensions, ft<sup>2</sup>;~~
- ~~A<sub>wall</sub> = area of the wall envelope component based on the exterior dimensions, ft<sup>2</sup>;~~
- ~~A<sub>fen</sub> = area of the fenestration envelope component based on the exterior dimensions, ft<sup>2</sup>;~~
- ~~A<sub>door</sub> = area of the door envelope component based on the exterior dimensions, ft<sup>2</sup>;~~

and

~~A<sub>floor</sub> = area of the floor envelope component based on the exterior dimensions, ft<sup>2</sup>.~~

~~5.2.2.2.2 Envelope Component U X A Term. When more than one assembly of ceilings, walls, fenestrations, doors, or floors is used, the (U X A) term for that envelope component shall be calculated using Equation 5-7. All U factors are air to air, including interior and exterior air films. Calculation of U factors shall be done in accordance with the procedures in chapters 20, 22, and 27 of the ASHRAE Handbook Fundamentals<sup>2</sup> and shall account for thermal bridges and anomalies. For example,~~

- ~~(b) wood framing members and webs in masonry construction (see chapters 20 and 22)~~
- ~~(b) fenestration (see chapter 27).~~

(Note: Delete Equation 5-7, which is not shown here.)  
where

- ~~U X A = sum of the products of the thermal transmittances of the individual assemblies multiplied by the areas of the individual assemblies, Btu/h·°F;~~
- ~~U<sub>i-n</sub> = thermal transmittances of the individual assemblies for an envelope component, Btu/h-ft<sup>2</sup>·°F, and~~
- ~~A<sub>i-n</sub> = areas of the individual assemblies for an envelope component based on exterior dimensions, ft<sup>2</sup>.~~

(Delete Section 5.4 and its subsections as shown and renumber all sections after Section 5.3 accordingly.)

~~5.4 Requirements for Manufactured Houses (Mobile Homes)~~

~~5.4.1 Zones. The requirement for manufactured houses (mobile homes) is an overall U<sub>o</sub> value for the entire envelope that changes with zones defined by state boundaries (see Figure 5-17). Hawaii and U.S. possessions are included in Zone I; Alaska is Zone III.~~

~~5.4.2 U<sub>o</sub> Requirement. The U<sub>o</sub> requirement applies to both single and double wide units and is presented in Table 5-4. See 5.2.2.2 for U<sub>o</sub> calculations.~~

(Delete Table 5-4 and renumber all tables after Table 5-3 and the references to these tables accordingly.)

**TABLE 5-4  
Manufactured House Requirements (Mobile Homes)**

Zone	U <sub>o</sub> Value
I	0.1005
II	0.0767
III	0.0596

(Delete Figure 5-17 in 90.2-2001, which was renumbered as Figure 5-17B by Addendum d. Also, renumber Figure 5-17A, which was added by Addendum d, as Figure 5-17.)

~~Figure 5-17 Manufactured housing zones.~~

(Revise Section 5.6.2.1 as shown.)

## 5.6.2 Air Leakage Requirements

**5.6.2.1** Windows shall be designed to limit air leakage. The air infiltration rate shall be as specified in the listed references, depending on the type of window.

- (a) The requirement for aluminum windows shall be 0.37 cfm/ft of sash crack, as specified in ANSI-IAAMA 101.<sup>19</sup>
- (b) The requirement for PVC windows shall be either 0.37 cfm/ft of sash crack, as specified in AAMA IOIV<sup>20</sup>, or 0.375 cfm/ft of sash crack, as specified in ASTM D 4099.<sup>21</sup>
- (c) The requirement for wood windows shall be 0.34 cfm/ft of sash crack, as specified in ANSI/NWWDA I.S. 2.<sup>22</sup>
- (d) ~~The requirement for manufactured housing windows shall be 0.50 cfm/ft<sup>2</sup> of window area, as specified in AAMA 1701.2.23.~~

(Revise Section 5.6.2.2 as shown.)

**5.6.2.2 Sliding Doors.** Sliding doors used for entry or exit from residential living units shall be designed to limit air leakage. The air infiltration rate shall be as specified in the listed references, depending on the type of door.

- (a) The requirement for aluminum sliding doors shall be 0.37 cfm/ft<sup>2</sup> of door area, as specified in ANSI/AAMA 101.<sup>19</sup>
- (b) The requirement for PVC sliding doors shall be either 0.37 cfm/ft<sup>2</sup> of door area, as specified in AAMA 101V<sup>20</sup>, or 0.375 cfm/ft<sup>2</sup> of door area, as specified in ASTM D 4099.<sup>21</sup>

- (c) The requirement for wood sliding doors shall be 0.34 cfm/ft<sup>2</sup> of door area, as specified in ANSI/NWWDA I.S. 3.<sup>24</sup>
- (d) ~~The requirement for manufactured housing sliding doors shall be 0.50 cfm/ft<sup>2</sup> of door area, as specified in AAMA 1701.2.23.~~

(Revise Section 5.6.2.3 as shown.)

**5.6.2.3 Swinging Doors.** Swinging door assemblies used for entry or exit from residential living units shall be designed to limit air leakage. The air infiltration rate shall not exceed 0.5 cfm/ft<sup>2</sup> of door area ~~except for manufactured housing swinging doors. The requirement for manufactured housing swinging doors shall be 1.0 cfm/ft<sup>2</sup> of door area, as specified in AAMA 1702.2.25~~

(Delete the following references in Section 10 and renumber all references after Reference 22 in Section 10 and the body of the standard accordingly.)

## 10. REFERENCES

- ~~<sup>23</sup>AAMA 1701.2 1985, Prime window & sliding glass door voluntary standard for utilization in manufactured housing. Des Plaines, Ill.: American Architectural Manufacturers Association.~~
- ~~<sup>25</sup>AAMA 1702.2 I 985, Swinging exterior passage door voluntary standard for utilization in manufactured housing. Des Plaines, IL: American Architectural Manufacturers Association.~~

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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.