

NFPA 501

Standard on Manufactured Housing

2005 Edition



NFPA, 1 Batterymarch Park, Quincy, MA 02169-7471
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NFPA 501
Standard on
Manufactured Housing
2005 Edition

This edition of NFPA 501, *Standard on Manufactured Housing*, was prepared by the Technical Committees on Manufactured Housing, released by the Technical Correlating Committee on Manufactured Housing, and acted on by NFPA at its November Association Technical Meeting held November 13–17, 2004, in Miami Beach, FL. It was issued by the Standards Council on January 14, 2005, with an effective date of February 7, 2005, and supersedes all previous editions.

This edition of NFPA 501 was approved as an American National Standard on February 7, 2005.

Origin and Development of NFPA 501

The 1997 edition of NFPA 501, *Standard on Manufactured Housing*, was based on the 1977 edition of NFPA 501B, *Standard for Mobile Homes*. The 1977 criteria were updated to include current technology and references, and the format was updated to conform with the NFPA *Manual of Style*.

This document was also based on the federal Manufactured Home Construction and Safety Standards, which, when originally established by the U.S. Department of Housing and Urban Development (HUD), were based on the 1977 edition of NFPA 501B. The scope of this document was to establish the minimum criteria for manufactured housing. Additional criteria were derived from earlier editions of NFPA 501B, *Standard for Mobile Homes*, and the current HUD regulations to address any future application for manufactured homes in the international marketplace. The current HUD regulations only address those structures sold within the United States. Information from NFPA 501 has already been used to update the Federal Manufactured Housing Construction and Safety Standards as administered by HUD.

The majority of the revisions to the 1999 edition were minor in nature and pertained to editorial clarification and revisions. There were significant revisions in the provisions on smoke detectors and smoke alarms. The revisions updated these provisions in order to recognize the current requirements of NFPA 72®, *National Fire Alarm Code*®. Revisions were also made to the electrical chapter so that it was in agreement with the provisions of NFPA 70, *National Electrical Code*®.

The 2000 edition was the first complete edition to be revised following HUD's selection of NFPA to develop revisions to the federal regulations (24 CFR 3280) for manufactured homes. Approximately 100 changes were accepted for that edition. Revisions updated the reference standards, updated plumbing provisions, revised load testing for trusses, and added requirements for smoke detection installations for multistory units and those with basements.

The 2003 edition continued its improvement and focused on NFPA's suite of manufactured housing documents, and was reviewed and revised based on some likely changes expected to emanate from the Manufactured Housing Improvement Act (MHIA) of 2000. Changes were incorporated that further reflected the desire to provide a more responsible approach to consumer concerns such as ensuring that consumer manual criteria reflect the proper reference in the CFR, that labels are attached to clearly visible locations, and that issues as diverse as the accessibility of manufactured housing units and the strengthening of criteria for handrails and guards were addressed. Other changes included improvements to the requirement for multi-story and multi-section homes, including the addition of an entirely new chapter on special construction considerations.

The 2005 edition incorporates a number of technical changes. New requirements are provided for stairs, materials of construction, energy conservation, water heaters, and supply ducts. Changes also have been made regarding the types of plumbing materials to be used and the installation practices regarding plumbing. In addition, reference standards have been updated as has certain terminology.

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NFPA 501

Standard on

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Information on referenced publications can be found in Chapter 14 and Annex D.

Chapter 1 General

1.1 Scope. This standard shall cover all the equipment and installations used in the design, construction, transportation, fire safety, plumbing, heat-producing, and electrical systems of manufactured homes that are designed to be used as dwelling units. This standard shall, to the maximum extent possible, establish performance requirements. In certain instances, however, the use of specific requirements is necessary.

1.2 Definitions. The following definitions are common to all chapters of this standard and are in addition to the definitions provided in individual chapters.

1.2.1 Administrative Regulations. Regulations promulgated by the regulatory agency for administration and enforcement of the provisions of this standard.

1.2.2* Approved. Acceptable to the authority having jurisdiction.

1.2.3* Authority Having Jurisdiction (AHJ). An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

1.2.4 Bay Window. A window assembly whose maximum horizontal projection is no more than 2 ft (610 mm) from the plane of an exterior wall and is elevated above the floor level of the home.

1.2.5 Certification Label. The approved form of manufacturer certification that is permanently affixed to each transportable section of each manufactured home that is subject to this standard (see Section 1.11).

1.2.6 Dwelling Unit. One or more habitable rooms, designed to be occupied by one or more persons, with facilities for living, sleeping, cooking, and eating.

1.2.7 Equipment. Materials, appliances, devices, fixtures, fittings, or accessories used in the construction of manufactured homes and in the fire safety, plumbing, heat-producing, and electrical systems of manufactured homes.

1.2.8 Federal Manufactured Home Construction and Safety Standard. A standard either promulgated or adopted under authority of the *National Manufactured Housing Construction and Safety Standards Act of 1974* (PL 93-383, as amended).

1.2.9 Installations. All arrangements and methods of construction, as well as fire safety, plumbing, heat-producing, and electrical systems used in manufactured homes.

1.2.10 Labeled. Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

1.2.11 Length of a Manufactured Home. A manufactured home's largest overall length in the traveling mode, including cabinets and other projections which 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.

1.2.12* Listed. Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.

1.2.13 Manufacturer. Any person engaged in manufacturing or assembling manufactured homes, including any person engaged in importing manufactured homes for resale.

1.2.14 Manufactured Home. A structure, transportable in one or more sections, which, in the traveling mode, is 8 body-ft (2.4 m) or more in width or 40 body-ft (12.2 m) or more in length or, when erected on site, is 320 ft² (29.7 m²) or more and which is built on a permanent chassis and designed to be used as a dwelling, with or without a permanent foundation, when connected to the required utilities, and includes plumbing, heating, air-conditioning, and electrical systems contained therein; except that such terms shall include any structure which meets all the requirements of this paragraph except the size requirements and with respect to which the manufacturer voluntarily files a certification required by the

regulatory agency. Calculations used to determine the number of square feet in a structure are based on the structure's exterior dimensions, measured at the largest horizontal projections when erected on site. These dimensions include all expandable rooms, cabinets, and other projections containing interior space, but do not include bay windows.

1.2.15 Manufactured Home Construction. All activities relating to the assembly and manufacture of a manufactured home, including but not limited to those relating to durability, quality, and safety.

1.2.16 Manufactured Home Safety. The performance of a manufactured home in such a manner that the public is protected against any unreasonable risk of the occurrence of accidents or any unreasonable risk of death or injury to the user or to the public if such accidents do occur due to the design or construction of the manufactured home.

1.2.17 Modular Home. A home constructed, all or in part, in accordance with a standard adopted, administered, and enforced by the regulatory agency, or under reciprocal agreement with the regulatory agency, for conventional site-built dwellings.

1.2.18 Multi-Wide. A manufactured home that is made up of two or more transportable sections.

1.2.19 Registered Engineer or Architect. A person licensed to practice engineering or architecture in a state, subject to all laws and limitations imposed by the state's Board of Engineering and Architecture Examiners. A registered engineer or architect is engaged in the professional practice of rendering service or creative work that requires education, training, and experience in engineering sciences and special knowledge of mathematical, physical, and engineering sciences for the purpose of securing compliance with specifications and design in such professional or creative work as consultation, investigation, evaluation, planning or design, and supervision of construction.

1.2.20 Regulatory Agency. The agency adopting, administering, and enforcing this standard.

1.2.21 Shall. Indicates a mandatory requirement.

1.2.22 Should. Indicates a recommendation or that which is advised but not required.

1.2.23 Single-Wide. A manufactured home that is made up of a single, transportable section.

1.2.24 State. Includes all 50 individual states that make up the United States, the District of Columbia, the Commonwealth of Puerto Rico, Guam, the U.S. Virgin Islands, and American Samoa.

1.2.25 Width of a Manufactured Home. A manufactured home's 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.

1.3 Consumer Manual Requirements. Consumer manuals shall be in accordance with 24 CFR 3282, "Manufactured Home Procedural and Enforcement Regulations," Section 3282.207.

1.4 Incorporation by Reference. The specifications, standards, and codes, or portions thereof, of the following organizations, where they are specified in this standard, shall be incorporated by reference. Where two or more referenced standards are equivalent in application, the manufacturer shall have the option to incorporate into the manufactured

home design and construction the referenced standard of their choosing.

Exception: When reference standards and this standard are inconsistent, the requirements of this standard shall prevail to the extent of the inconsistency.

AA — Aluminum Association, 900 19th Street NW, Suite 300, Washington, DC 20006

AAMA — American Architectural Manufacturers Association, 1327 Jonas Drive, Ann Arbor, MI 48105

AF&PA — American Forest and Paper Association, 111 19th Street NW, Suite 800, Washington, DC 20036 [previously named (N)FPA National Forest Products Association]

AGA — American Gas Association, 400 N. Capitol Street NW, Washington, DC 20001

AISC — American Institute of Steel Construction, One East Wacker Drive, Suite 3100, Chicago, IL 60601

AISI — American Iron and Steel Institute, 1101 17th Street NW, Suite 1300, Washington, DC 20036

AITC — American Institute of Timber Construction, 7012 S. Revac Parkway, Suite 140, Englewood, CO 80112

ANSI — American National Standards Institute, 25 West 43rd Street, New York, NY 10036

APA — The Engineered Wood Association, 7011 South 19th Street, Tacoma, WA 98466-5399

ARI — Air Conditioning and Refrigeration Institute, 1501 Wilson Boulevard, 6th Floor, Arlington, VA 22209-2403

ASCE — American Society of Civil Engineers, 1801 Alexander Bell Drive, Reston, VA 20191-4400

ASHRAE — American Society of Heating, Refrigeration and Air Conditioning Engineers, 1791 Tullie Circle NE, Atlanta, GA 30329

ASME — American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016-5990

ASSE — American Society of Sanitary Engineering, 28901 Clemens Road, Suite 100, Westlake, OH 44145

ASTM — American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959

CISPI — Cast Iron Soil Pipe Institute, 5959 Shallowford Road, Suite 419, Chattanooga, TN 37421

CSA International, 8501 East Pleasant Valley Road, Cleveland, OH 44131

DOC — U.S. Department of Commerce, National Institute of Standards and Technology, Office of Engineering Standards, Room A-166, Technical Building, Washington, DC 20234

FS — Federal Specifications, General Services Administration, Specifications Branch, Room 6039, GSA Building, Seventh and D Streets SW, Washington, DC 20407

HPVA — Hardwood Plywood and Veneer Association, P.O. Box 2789, Reston, VA 22090 [previously named (HPMA) Hardwood Plywood Manufacturers Association]

HUD-FHA — Department of Housing and Urban Development, 451 Seventh Street SW, Washington, DC 20410

HUD — USER, Department of Housing and Urban Development, HUD User, P.O. Box 280, Germantown, MD 20874

IAPMO — International Association of Plumbing and Mechanical Officials, 5001 E. Philadelphia St., Ontario, CA 91761-2816

IITRI — IIT Research Institute, 10 West 35th Street, Chicago, IL 60616

MIL — Military Specifications and Standards, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120

NFPA — National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471

NFRC — National Fenestration Rating Council, 8484 Georgia Avenue, Suite 320, Silver Spring, MD 20910

NPA — National Particleboard Association, 18928 Premiere Court, Gaithersburg, MD 20879

NSF — NSF International, P.O. Box 130140, Ann Arbor, MI 48113-0140

SAE — Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096

SJI — Steel Joist Institute, 1205 48th Avenue North, Suite A, Myrtle Beach, SC 29577

TPI — Truss Plate Institute, 583 D'Onofrio Drive, Suite 200, Madison, WI 53719

UL — Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096

WDMA — Window and Door Manufacturers Association, 1400 E. Touhy Avenue, Suite 470, Des Plaines, IL 60018

1.5 Data Plate. Each manufactured home shall bear a data plate affixed in a permanent manner near the main electrical panel or in another readily accessible and visible location. Each data plate either shall be made of a material that will receive typed information, as well as preprinted information, that can be cleaned of ordinary smudges or household dirt without removing information contained on the data plate; or it shall be covered in a permanent manner with materials that will make it possible to clean the data plate of ordinary dirt and smudges without obscuring the information. (See 6.5.3.5.) Each data plate shall contain not less than the following information:

- (1) Name and address of the manufacturing plant where the manufactured home was manufactured
- (2) Serial number and model designation of the unit and the date the unit was manufactured
- (3) The statement: "This manufactured home is designed to comply with the NFPA Standard 501 in effect at the time of manufacture."
- (4) A list of the certification label(s) number(s) that is affixed to each transportable manufactured section in accordance with Section 1.11
- (5) A list of major factory-installed equipment, including the manufacturer's name and the model designation of each appliance
- (6) Reference to the roof load zone and wind load zone for which the home is designed and duplicates of the wind zone and roof load zone maps shown in Figure 6.5.3.1(a) and Figure 6.5.3.3.1. (This information shall be permitted to be combined with the heating/cooling certificate and insulation zone map required by Sections 8.10 and 8.11.)
- (7) The statement: "This home has _____ has not _____ (appropriate blank to be checked by manufacturer) been equipped with storm shutters or other protective coverings for windows and exterior door openings. For homes designed to be located in Wind Zones II, III, and IV, which have not been provided with shutters or equivalent covering devices, it is strongly recommended that the home be made ready to be equipped with these devices in accordance with the method recommended in the manufacturer's printed instructions."
- (8) The statement: "Design approval by . . ." followed by the name of the agency that approved the design

1.6 Serial Number. A serial number that will identify the manufacturer and the state where the manufactured home is manufactured shall be stamped into the foremost cross member. Letters and numbers shall be $\frac{3}{8}$ in. (9.5 mm) minimum in height. Numbers shall not be stamped into the hitch assembly or drawbar.

1.7 Excluded Structures. Certain structures shall be permitted to be exempted from this standard by the regulatory agency as modular homes under 24 CFR 3282.12, "Excluded Structures — Modular Homes."

1.8 Waivers.

1.8.1 Where any material piece of equipment or system does not meet precise requirements or specifications defined in this standard, the manufacturer shall be permitted to submit a written application to the regulatory agency for a waiver of the precise requirement or specification.

1.8.2 The written application for a waiver shall identify the specific provisions of this standard for which a waiver is requested, the specific alternative to the precise requirement or specification that is proposed by the manufacturer, and any supporting data.

1.8.3 The regulatory agency shall be permitted to require, at the manufacturer's expense, additional data, engineering calculations, and testing to demonstrate that the alternative proposed by the manufacturer will produce the equivalent safety and performance of the precise requirement or specification requested to be waived.

1.8.4 The regulatory agency shall issue written approval or disapproval of waiver applications within 30 calendar days from receipt of the application and any data, calculations, or test results requested under the authority of 1.8.3.

1.8.5 A copy of the written approval of a manufacturer's application for a waiver of precise requirements or specifications defined in this standard shall be included as an attachment to the consumer manual required by Section 1.3.

1.9 Interpretive Bulletins.

1.9.1 The regulatory agency shall be permitted to issue interpretive bulletins for the following purposes:

- (1) To clarify the meaning of any administrative regulation adopted by the regulatory agency related to the administration and enforcement of this standard
- (2) To clarify the meaning of any precise requirement or specification identified in this standard

1.9.2 Interpretive bulletins issued by the regulatory agency shall be uniquely identified by the year issued and the sequential number of the information bulletin issued within that year, beginning with the number 1.

1.9.3 Copies of interpretive bulletins issued by the regulatory agency shall be provided by first class mail to the addresses on record with the regulatory agency for each manufacturer and to each design approval agency, inspection agency, state agency, or other agency that is identified by administrative regulations.

1.9.4 Until modified or revoked by a subsequent interpretive bulletin, interpretive bulletins issued by the regulatory agency shall have the same weight and effect as the precise requirements and specifications of this standard or the administrative regulations.

1.10 Use of Alternative Construction. Applications for regulatory agency approval of alternative construction methods shall be made in accordance with Section 1.8.

1.11 Certification Label.

1.11.1 A permanent label shall be affixed to each transportable section of each manufactured home subject to this

standard. This label shall be separate and distinct from the data plate required by Section 1.5.

1.11.2 The label shall be approximately 2 in. $\times$ 4 in. (50 mm $\times$ 100 mm) in size and shall be permanently attached to the manufactured home by means that render it difficult to remove without defacing it. The label shall be etched on a 0.32 in. thick (8.2 mm) aluminum plate or other material identified by the administrative regulations. The label shall be etched or stamped with a sequence of letters identifying the production inspection agency, followed by a series of sequential numbers in a manner identified in the administrative regulations.

1.11.3 The label shall read as follows:

“As evidenced by this label, No. (e.g., ABC 000001), the manufacturer certifies to the best of the manufacturer’s knowledge and belief that this manufactured home has been constructed and inspected in accordance with the requirements of the (regulatory agency name) and is in conformance with the edition of NFPA 501 in effect on the date of manufacture. See data plate.”

1.11.4* The label shall be located at the taillight end of each transportable section of the manufactured home approximately 1 ft (300 mm) up from the floor and 1 ft (300 mm) in from the road side, or as near that location on a permanent part of the exterior of the manufactured home section as practicable. When locating the label on the taillight end of a transportable section will prevent the label from being visible after the manufactured home section is installed at the installation site, the label shall be installed on a permanent part of the exterior of the manufactured home section, in a visible location as specified in the approved design.

Chapter 2 Referenced Publications (Reserved)

Chapter 3 Reserved

Chapter 4 Planning Considerations

4.1 Scope. The purpose of this chapter shall be to state the planning requirements of manufactured homes to ensure the adequacy of architectural planning considerations that assist in determining a safe and healthful environment.

4.2 Special Definitions. The following definitions shall be applicable to this chapter.

4.2.1 Gross Floor Area. All wall-to-wall space, including recessed entries not to exceed 5 ft² (0.46 m²) and areas under built-in vanities and similar furniture. Where the ceiling height is less than that specified in Section 4.4, the floor area under such ceilings shall not be included. Floor area of closets shall not be included in the gross floor area.

4.2.2 Habitable Room. A room or enclosed floor space arranged for living, eating, food preparation, or sleeping purposes, not including bathrooms, foyers, hallways, and other accessory floor space.

4.2.3 Laundry Area. An area containing or designed to contain a laundry tray, clothes washer, and/or clothes dryer.

4.3 Light and Ventilation.

4.3.1 Lighting. Each habitable room shall be provided with exterior windows and/or doors having a total glazed area of not less than 8 percent of the gross floor area.

4.3.1.1 Kitchens, bathrooms, toilet compartments, laundry areas, and utility rooms shall be permitted to be provided with artificial light in lieu of windows.

4.3.1.2 In bathrooms, ceiling-mounted lighting fixtures and wall-mounted lighting fixtures shall not be controlled by the same switch.

4.3.1.3 Linear fluorescent fixtures shall utilize T-8 lamps or lamps of equal or greater efficiency.

4.3.1.4 Rooms and areas shall be permitted to be combined for the purpose of providing the required natural lighting, provided that at least one-half of the common wall area is open and unobstructed and the open area is at least equal to 10 percent of the combined floor area or 25 ft² (2.3 m²), whichever is greater.

4.3.1.5 Required glazed openings shall be permitted to face into a roofed porch where the porch abuts a street, yard, or court and the longer side of the porch is at least 65 percent open and unobstructed and the ceiling height is not less than 7 ft (2.1 m).

4.3.2 Whole-House Ventilation. Each manufactured home shall be provided with whole-house ventilation having a minimum capacity of 0.035 ft³/min $\cdot$ ft² (10.8 L/min $\cdot$ m²) of interior floor space or its hourly average equivalent. This ventilation capacity shall be in addition to any openable window area. In no case shall the installed ventilation capacity of the system be less than 50 cfm (1440 L/min) nor more than 90 cfm (2520 L/min).

4.3.2.1 The ventilation capacity shall be permitted to be provided by a mechanical system, or a combination passive and mechanical system. The ventilation system or provisions for ventilation shall not create a positive pressure in U_0 value Zone 2 and Zone 3 or a negative pressure condition in U_0 value Zone 1 in excess of 0.03 in. of water (7 Pa).

4.3.2.2 The ventilation system or provisions for ventilation shall exchange air directly with the exterior of the home, except it shall not draw or expel air with the space underneath the home. The ventilation system or provisions for ventilation shall not draw or expel air into the floor, wall, or ceiling/roof systems, even if those systems are vented. The ventilation system shall be designed to ensure that outside air is distributed to all bedrooms and main living areas. The combined use of undercut doors or transom grilles connecting those areas to the room where the mechanical system is located shall be deemed acceptable.

4.3.2.3 The ventilation system or a portion thereof shall be permitted to be integral with the home’s heating or cooling system. The system shall be capable of operating independently of the heating or cooling modes. A ventilation system that is integral with the heating or cooling system shall be listed as part of the heating and cooling system or listed as suitable for use therewith.

4.3.2.4 The ventilation system or portion thereof shall also be permitted to be one of the bathroom exhaust fans required by 4.3.3.3 provided the following criteria are met:

- (1) Maximum zone rating of 1.0
- (2) Designed for continuous operation and a minimum 10-year life

4.3.2.5 A mechanical ventilation system, or mechanical portion thereof, shall be provided with a manual control, and shall be permitted to be provided with automatic timers or humidistats.

4.3.2.6 Instructions for correctly operating and maintaining whole-house ventilation systems shall be included with the homeowner's manual. The instructions shall encourage occupants to operate these devices whenever the home is occupied and to refer to the whole-house ventilation labeled control. The whole-house ventilation label shall be permanent, shall state "Whole-House Ventilation," and shall be attached to the whole-house ventilation control.

4.3.3 Additional Ventilation.

4.3.3.1 At least half of the minimum required glazed area in 4.3.1 shall be openable directly to the outside of the manufactured home for unobstructed ventilation. These same ventilation requirements shall apply to rooms combined in accordance with 4.3.1.4.

4.3.3.2 Kitchens shall be provided with a mechanical ventilation system that is capable of exhausting 100 cfm (2830 L/min) to the outside of the home. The exhaust fan shall be located as close as possible to the range or cooktop, but in no case shall it be farther than 10 ft (3.1 m) horizontally from the range or cooktop.

4.3.3.3 Each bathroom and separate toilet compartment shall be provided with a mechanical ventilation system capable of exhausting 50 cfm (1415 L/min) to the outside of the home. A separate toilet compartment shall be permitted to be provided with 1.5 ft² (0.14 m²) of openable glazed area in place of mechanical ventilation.

Exception: Openable glazed area shall not be permitted to replace mechanical ventilation in U_o value Zone 3.

4.4 Ceiling Heights.

4.4.1 Every habitable room and bathroom shall have a minimum ceiling height of not less than 7 ft (2.1 m) for a minimum of 50 percent of the room's floor area. The remaining area shall be permitted to have a ceiling with a minimum height of 5 ft (1.5 m). Minimum height under dropped ducts, beams, and other similar projections shall be 6 ft 4 in. (1.9 m).

4.4.2 Hallways and foyers shall have a minimum ceiling height of 6 ft 6 in. (2 m).

4.5 Exit Facilities — Exterior Doors.

4.5.1 Number and Location of Exterior Doors. Manufactured homes shall have a minimum of two exterior doors remotely located from each other.

4.5.1.1 Required egress doors shall not be located in rooms where a lockable interior door must be used in order to exit.

4.5.1.2 In order for exit doors to be considered remote from each other, they shall comply with 4.5.1.2.1 through 4.5.1.2.4.

4.5.1.2.1 Doors. The two required exit doors shall not be in the same room or in a group of rooms that are not defined by fixed walls.

4.5.1.2.2 Single-Wide Units. Doors shall not be less than 12 ft (3.7 m) c-c from each other, as measured in any straight line direction, regardless of the length of path of travel between doors.

4.5.1.2.3 Multi-Wide Units. Doors shall not be less than 20 ft (6.1 m) c-c from each other, as measured in any straight line direction, regardless of the length of path of travel between doors.

4.5.1.2.4 Access. One of the required exit doors shall be accessible from the doorway of each bedroom without traveling more than 35 ft (10.7 m). The travel distance to the exit door shall be measured on the floor or other walking surface along the centerline of the natural path of travel starting at the center of the bedroom door, curving around any corners or permanent obstructions with a 1 ft clearance therefrom, and ending at the center of the exit door.

4.5.1.2.5 If an exit door is not accessible without traveling more than 35 ft (10.7 m) as required by 4.5.1.2.4, a fire sprinkler system that complies with Section 5.10 shall be required.

4.5.2 Door Design and Construction.

4.5.2.1 Exterior swinging doors shall be constructed in accordance with Section 7.5. Exterior sliding glass doors shall be constructed in accordance with Section 7.3.

4.5.2.2* All exterior swinging doors shall provide a minimum 28 in. wide × 74 in. high (710 mm × 1880 mm) opening. All exterior sliding glass doors shall provide a minimum 28 in. wide × 72 in. high (710 mm × 1830 mm) opening. Door seals shall be permitted to reduce the opening, either vertically or horizontally, a maximum of 1 in. (25.4 mm).

4.5.2.3 Each swinging exterior door, other than screen or storm doors, shall have a key-operated lock that has a deadlocking latch or a key-operated dead bolt with a passage latch. Locks shall not require the use of a key for operation from the inside.

4.5.2.4 All exterior doors, including storm and screen doors, that open outward shall be provided with a safety door check.

4.6 Exit Facilities — Egress Windows and Devices.

4.6.1 Every room designed expressly for sleeping purposes, unless it has an exit door (*see Section 4.5*), shall have at least one outside window or approved exit device meeting the requirements of Section 7.4.

4.6.2 The bottom of the window opening shall not be more than 36 in. (914 mm) above the floor.

4.6.3 Locks, latches, operating handles, tabs, and any other window screen or storm window devices that need to be operated in order to permit exiting shall not be located in excess of 54 in. (1370 mm) from the finished floor.

4.6.4 Integral rolled-in screens shall not be permitted in an egress window unless the window is of the hinged type.

4.7 Interior Privacy. Bathroom and toilet compartment doors shall be equipped with a privacy lock.

4.8 Interior Passage Doors.

4.8.1* All interior swinging doors shall have a minimum clear opening width of 27 in. (686 mm).

4.8.2 Interior doors having passage hardware without a privacy lock, or with a privacy lock not engaged, shall open from either side by a single movement in any direction of the hardware mechanism.

4.8.3 When provided, each privacy lock on interior doors shall have an emergency release on the outside to permit entry when the lock has been locked by a locking knob, lever, button, or other locking device from the inside.

4.9 Room Requirements.

4.9.1 Every manufactured home shall have at least one living area with not less than 150 ft² (13.9 m²) of gross floor area.

4.9.2 Rooms designed for sleeping purposes shall have a minimum gross square foot floor area, as follows:

- (1) All bedrooms shall have at least 50 ft² (4.6 m²) of floor area.
- (2) Bedrooms designed for two or more people shall have 70 ft² (6.5 m²) of floor area plus 50 ft² (4.6 m²) for each person in excess of two.
- (3) Every room designed for sleeping purposes shall have accessible clothes hanging space with a minimum inside depth of 22 in. (560 mm) and shall be equipped with a rod and shelf.

4.10 Minimum Room Dimensions. The gross floor area required by 4.9.1 and 4.9.2 shall have no clear horizontal dimension less than 5 ft (1.5 m). (*See 4.2.1 for a definition of gross floor area.*)

4.11* Bathroom Passage Doors. All single-section bathroom passage doors shall have a minimum clear opening width of 23 in. (584 mm), and multi-section bathroom passage doors shall have a minimum clear opening width of 27 in. (686 mm).

4.11.1 Toilet Compartments. Each toilet compartment shall have a minimum width of 30 in. (760 mm), with a minimum clear space of 21 in. (530 mm) in front of each toilet. Toilets located adjacent to a wall shall have the centerline of the toilet located a minimum of 15 in. (380 mm) from the wall. Toilets located adjacent to a tub shall have the centerline of the toilet located a minimum of 12 in. (300 mm) from the outside edge of the tub.

4.12* Hallways. Hallways shall have a minimum horizontal dimension of 28 in. (710 mm) for single-section homes, and a minimum horizontal dimension of 36 in. (910 mm) for multi-section homes, measured from the interior finished surface of one wall to the interior finished surface of the opposite wall. Where appliances are installed in a laundry area, the measurement shall be taken from the front of the appliance to the opposite finished interior surface. Where appliances are not installed and a laundry area is provided, the area shall have a minimum clear depth of 27 in. (690 mm) in addition to the 28 in. (710 mm) required for passage. In addition, a notice of the available clearance for washer/dryer units shall be posted in the laundry area. Minor protrusions into the minimum hallway width by doorknobs, trim, smoke detectors, or light fixtures shall be permitted.

4.13 Glass and Glazed Openings.

4.13.1 Windows and Sliding Glass Doors. All windows and sliding glass doors shall meet the requirements of Section 7.3.

4.13.2 Safety Glazing. Glazing in hazardous locations shall meet the requirements of 4.13.2.1 and those of 4.13.2.2 or 4.13.2.3.

4.13.2.1 Safety Glazing Materials. Safety glazing material shall meet the test requirements of CPSC 16 CFR 1201, "Safety Glazing Test Standard," or ANSI Z97.1, *Safety Performance Specifications and Methods of Test for Safety Glazing Materials Used in Buildings*.

4.13.2.2 Hazardous Location Glazing. Where located and subject to human impact loads, except as outlined in 4.13.2.3, safety glazing shall be installed in the following hazardous locations:

- (1) Glazing in ingress and egress doors, except jalousies.
- (2) Glazing in fixed and sliding panels of sliding-type doors.
- (3) Glazing in storm-type doors.
- (4) Glazing in unframed side-hinged swinging doors.
- (5) Glazing in doors and fixed panels less than 60 in. (1524 mm) above the room floor level that enclose bathtubs, showers, hydromassage tubs, hot tubs, whirlpools, saunas, and steam rooms.
- (6) Glazing within 12 in. (305 mm) horizontally and 60 in. (1524 mm) vertically, adjacent to and in the same plane of a door. The 12 in. (305 mm) dimension is measured from the edge of the door in the closed position. The 60 in. (1524 mm) dimension is measured from the room floor level.
- (7) Glazing within 36 in. (914 mm) of an interior room walking surface that meets all of the following criteria:
 - (a) Individual glazed panel exceeds 9 ft² (0.836 m²) in exposed area.
 - (b) The bottom edge of the exposed glazing is less than 19 in. (483 mm) above the room floor level.
 - (c) The top edge of the exposed glazing is greater than 36 in. (914 mm) above the room floor level.
- (8) Glazing in guardrails and railings.

4.13.2.3 Locations Not Considered Hazardous. The following are not required to meet the requirements of 4.13.2.2:

- (1) Openings in doors through which a 3 in. (76 mm) sphere is unable to pass
- (2) Leaded and decorative glazed panels
- (3) Glazing as outlined in 4.13.2.2(6), where an intervening wall or other permanent barrier exists between the door and the glazing
- (4) Glazing as outlined in 4.13.2.2(7), where a protective bar or member is installed horizontally between 34 in. (864 mm) and 38 in. (965 mm) above the room floor level. The bar or member shall be a minimum 1½ in. (38 mm) in height and capable of withstanding a horizontal load of 50 lb per linear foot (74.5 kg/m)
- (5) Mirrors hung or mounted on a flush door surface or solid wall surface

4.14 Landings.

4.14.1 General. A minimum dimension of travel distance of a landing shall be 3 ft (914 mm). The minimum width of a landing shall not be less than the stairway or door that it serves. Landings shall be located as required by Section 4.14.

4.14.1.1 Landings for Stairways. There shall be a floor or landing at the top and bottom of each stairway.

Exception: At the top of an interior flight of basement stairs, provided a door does not swing over the stairs.

4.14.1.2 Doors. A landing or floor shall be located on each side of an interior doorway. The maximum threshold height above the floor or landing shall be ½ in. (13 mm) provided that thresholds more than ¼ in. (6 mm) above the adjacent floor shall be beveled with a slope not steeper than 1 in 2.

4.15 Handrails.

4.15.1 General. A minimum of one handrail meeting the requirements of this section shall be installed on all stairways consisting of two or more risers. Single-riser stairs not at doors shall also have a minimum of one handrail located along the normal path of travel and complying with 4.15.3.2. Handrails shall be securely attached to structural framing members. A minimum space of 1½ in. (38 mm) shall be provided between the adjoining wall surface and the handrail.

4.15.2 Handrail Height. Handrails shall be installed between 34 in. (864 mm) and 38 in. (965 mm) measured vertically from the leading edge of the stairway treads except that handrails installed up to 42 in. (1067 mm) high shall be permitted if serving as the upper rails of guards required by Section 4.16.

4.15.3 Continuity.

4.15.3.1 Required handrails shall be continuous from a point directly above the leading edge of the lowest stair tread to a point directly above the leading edge of the landing or floor surface at the top of the stairway. If the handrail is extended at the top of the stairway flight, the extension shall parallel the floor or landing surface and shall be at the same height as the handrail is above the leading edges of the treads. If the handrail is extended at the base of the stair, it shall continue to slope parallel to the stair flight for a distance of one tread depth, measured horizontally, before being terminated or returned or extended horizontally. The ends of handrails shall return into a wall, or terminate in a safety terminal or newel post.

4.15.3.2 Continuity of Required Handrails Serving Single-Riser Stairs. Handrails serving single-riser stairs shall, at a minimum, extend from a point between 34 in. (864 mm) and 38 in. (965 mm) above the finished floor or landing and a minimum of 11 in. (279 mm), measured horizontally, beyond the face of the riser, to a point between 34 in. (864 mm) and 38 in. (965 mm) above the finished floor or landing and directly above the riser. The ends of handrails shall return into a wall and terminate in a safety terminal or newel post. Acceptable equivalent measures shall include other rails or features providing similar visual cueing for the step and graspability as required by 4.15.4.

4.15.4 Graspability. Required handrails shall, if circular in cross section, have a minimum 1¼ in. (32 mm) and a maximum 2 in. (51 mm) diameter dimension. Handrails with a noncircular cross section shall have a perimeter dimension of at least 4 in. (102 mm) and not more than 6¼ in. (159 mm) with a maximum cross-section dimension of not more than 2¼ in. (57 mm). A handrail shape that provides equivalent graspability shall be accepted. The handgrip portion of the handrail shall have a smooth surface. Edges shall have a minimum ⅛ in. (3.2 mm) radius. Handrails shall be continuously graspable along their entire length except that brackets or balusters are not considered obstructions to graspability if they do not project horizontally beyond the sides of the handrail within 1½ in. (38 mm) of the bottom of the handrail.

4.15.5 Handrails shall be designed to resist a load of 20 lb/ft (0.29 kN/m) applied in any direction at the top and to transfer this load through the supports to the structure. All handrails shall be able to resist a single concentrated load of 200 lb (0.89 kN), applied in any direction at any point along the top,

and have attachment devices and supporting structures to transfer this loading to appropriate structural elements of the building. This load shall not be required to be assumed to act concurrently with the loads specified in this section.

4.16 Guards.

4.16.1 Porches, balconies, or raised floor surfaces located more than 30 in. (762 mm) above the floor or grade below shall have guards not less than 36 in. (914 mm) in height. Open sides of stairs with a total rise of more than 30 in. (762 mm) above the floor or grade below shall have guards not less than 34 in. (864 mm) in height measured vertically from the nosing of the treads. Balconies and porches on the second floor or higher shall have guards a minimum of 42 in. (1067 mm) in height.

4.16.2 Guard Opening Limitations. Required guards on open sides of stairways, raised floor areas, balconies, and porches shall have intermediate rails or ornamental closures that do not allow passage of a sphere 4 in. (100 mm) in diameter. Required guards shall not be constructed with horizontal rails or other ornamental pattern that results in a ladder effect.

4.16.2.1 The triangular openings formed by the riser, tread and bottom rail of a guard at the open side of the stairway shall be permitted to be of such a size that a sphere 6 in. (152 mm) cannot pass through.

4.16.2.2 Guard systems shall be designed to resist a load of 20 lb/ft (0.29 kN/m) applied in any direction at the top and to transfer this load through the supports to the structure. All guard systems shall be able to resist a single concentrated load of 200 lb (0.89 kN), applied in any direction at any point along the top and have attachment devices and supporting structures to transfer this loading to appropriate structural elements of the building. This load shall not be required to be assumed to act concurrently with the loads specified in this section.

4.17 Stairway Illumination. All interior and exterior stairways shall be provided with a means to illuminate the stair, including the landings and treads. Interior stairs shall be provided with an artificial light source located in the immediate vicinity of each landing at the top and bottom of the stair. For interior stairs the artificial light sources shall be capable of illuminating treads and landings to levels not be less than 10 foot-candles (108 lx) measured at the center of treads and landings. Exterior stairs shall be provided with an artificial light source located in the immediate vicinity of the top landing of the stair.

Exception No. 1: An artificial light source is not required at the top and bottom landing, provided an artificial light source is located directly over each stair section.

Exception No. 2: Illumination measurements are not required where the installed artificial light sources are designed for a minimum of two incandescent lamps with a total rating, per light fixture, of at least 120 watts and not less than two such light fixtures are provided for each story-height portion of a stairway.

Exception No. 3: Illumination measurements are not required where the installed artificial light sources are designed for fluorescent or other lamp types capable of providing a minimum light output equivalent to that from 240 watts of incandescent lamps for each story-height portion of a stairway.

Chapter 5 Fire Safety

5.1 Scope. The purpose of this chapter shall be to set forth requirements that will ensure reasonable fire safety to the occupants by reducing fire hazards and providing methods for early detection.

5.2 Definitions. The following definitions shall be applicable to Chapters 5, 10, and 11.

5.2.1 Combustible Material. Any material not meeting the definition of limited-combustible or noncombustible material.

5.2.2 Flame Spread Index. The measurement of the propagation of flame on the surface of materials or their assemblies as determined by recognized standard tests conducted as required by this chapter.

5.2.3 Interior Finish. The surface material of walls, fixed or movable partitions, ceilings, columns, and other exposed interior surfaces affixed to the home's structure, including any materials such as paint or wallpaper and the substrate to which they are applied. Interior finish shall not include the following: (1) trim and sealant 2 in. (50 mm) or less in width adjacent to the cooking range and in furnace and water heater spaces, provided it is installed in accordance with the requirements of 5.3.2.3 or 5.3.2.4, and trim 6 in. (152 mm) or less in width in all other areas; (2) windows and frames; (3) single doors and frames and a series of doors and frames not exceeding 5 ft (1.5 m) in width; (4) skylights and frames; (5) casings around doors, windows, and skylights not exceeding 4 in. (102 mm) in width; (6) furnishings that are not permanently affixed to the home's structure; (7) baseboards not exceeding 6 in. (152 mm) in height; (8) light fixtures, cover plates of electrical receptacle outlets, switches, and other devices; (9) decorative items attached to walls and partitions (e.g., pictures, decorative objects, etc.) constituting no more than 10 percent of the aggregate wall surface area in any room or space not more than 32 ft² (3.0 m²) in surface area, whichever is less; (10) plastic light diffusers, when suspended from a material that meets the interior finish provisions of 5.3.2; (11) coverings and surfaces of exposed wood beams; (12) decorative items that include the following: (a) nonstructural beams not exceeding 6 in. (152 mm) in depth and 6 in. (152 mm) in width and spaced not closer than 4 ft (1.2 m) on center; (b) nonstructural latticework; (c) mating and closure molding; (d) other items not affixed to the home's structure.

5.2.4 Limited-Combustible. A material that meets the following criteria: $\frac{5}{16}$ in. (8 mm), or thicker, gypsum board, and the definition of Section 2-1 of NFPA 220, *Standard on Types of Building Construction*, which states: A building construction material not complying with the definition of noncombustible material that, in the form in which it is used, has a potential heat value not exceeding 3500 Btu/lb (8136 kJ/kg), where tested in accordance with NFPA 259, *Standard Test Method for Potential Heat of Building Materials*, and complies with (a) or (b): (a) Materials having a structural base of noncombustible material, with a surfacing not exceeding a thickness of $\frac{1}{8}$ in. (3.2 mm) that has a flame spread index not greater than 50; and (b) Materials, in the form and thickness used, other than as described in (a), having neither a flame spread index greater than 25 nor evidence of continued progressive combustion and of such composition that surfaces that would be exposed by cutting through the material on any plane would have neither a flame spread index greater than 25 nor evi-

dence of continued progressive combustion. (Materials subject to increase in combustibility or flame spread index beyond the limits herein established through the effects of age, moisture, or other atmospheric condition shall be considered combustible.)

5.2.5 Noncombustible Material. A material that, in the form in which it is used and under the conditions anticipated, will not ignite, burn, support combustion, or release flammable vapors when subjected to fire or heat. Materials that are reported as passing ASTM E 136, *Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C*, shall be considered noncombustible materials.

5.2.6 Notification Appliance. A fire alarm system component such as a bell, horn, speaker, light, or text display that produces audible, tactile, or visible outputs, or any combination thereof.

5.2.7 Single-Station Alarm. A detector comprising an assembly incorporating a sensor, control components, and an alarm notification appliance in one unit operated from a power source either located in the unit or obtained at the point of installation.

5.2.8 Single-Station Alarm Device. An assembly incorporating the smoke detector sensor, the electrical control equipment, and the alarm-sounding device in one unit.

5.2.9 Smoke Alarm. A single or multiple station alarm responsive to smoke.

5.2.10 Smoke Detector. A device that detects visible or invisible particles of combustion.

5.2.11 Visible Notification Appliance. A notification appliance that alerts by the sense of light.

5.3 Flame-Spread Limitations and Fire Protection Requirements.

5.3.1 Establishment of Flame-Spread Index.

5.3.1.1 The surface flame-spread index of interior-finish material shall not exceed the values shown in 5.3.2 when tested in accordance with NFPA 255, *Standard Method of Test of Surface Burning Characteristics of Building Materials*. A radiant panel index of the same value shall be permitted to be determined in accordance with ASTM E 162, *Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source*.

5.3.1.2 The following materials shall not need to be tested to establish their flame-spread index unless a lower rating is required.

- (1) Flame-Spread Index — 76 to 200:
 - (a) 0.035 in. (0.9 mm), or thicker, high-pressure laminated plastic panel countertop
 - (b) $\frac{1}{4}$ in. (6 mm), or thicker, unfinished plywood with phenolic or urea glue
 - (c) Unfinished dimension lumber [1 in. (25 mm), or thicker, nominal boards]
 - (d) $\frac{3}{8}$ in. (10 mm) or thicker unfinished particle board with phenolic or urea binder
 - (e) The following materials, either natural gum-varnished or latex- or alkyd-painted:
 - i. $\frac{1}{4}$ in. (6 mm), or thicker, plywood
 - ii. $\frac{3}{8}$ in. (10 mm), or thicker, particleboard
 - iii. 1 in. (25 mm), or thicker, nominal board

- (f) $\frac{5}{16}$ in. (8 mm) gypsum board with decorative wallpaper
 - (g) $\frac{1}{4}$ in. (6 mm), or thicker, unfinished hardboard
 - (h) $\frac{1}{4}$ in. (6 mm), or thicker, unfinished wood structural panels with phenolic or other exterior glue
- (2) Flame-Spread Index — 25 to 200:
- (a) Painted metal
 - (b) Mineral-based acoustic tile
 - (c) $\frac{5}{16}$ in. (8 mm), or thicker, unfinished gypsum wallboard (both latex- or alkyd-painted)
 - (d) Ceramic tile

Use of these material applications shall not waive the requirements of 5.3.3 or Section 5.4.

5.3.2 Flame-Spread Index Requirements.

5.3.2.1 The interior finish of walls, columns, and partitions shall not have a flame-spread index exceeding 200, except as otherwise specified herein.

5.3.2.2 Ceiling interior finish shall not have a flame-spread index exceeding 75.

5.3.2.3 Walls adjacent to or enclosing a furnace or water heater, and the ceilings above them, shall have an interior finish with a flame-spread index not exceeding 25.

Exception: Sealants and other trim materials 2 in. (50 mm) or less in width that are used to finish adjacent surfaces within these spaces, provided that all joints are completely supported by framing members or by materials having a flame-spread index not exceeding 25.

5.3.2.4* Exposed interior finishes adjacent to the cooking range shall have a flame-spread index not exceeding 50. (See Section 5.4.)

Exception: Backsplashes not exceeding 6 in. (152 mm) in height and sealants and other trim materials 2 in. (50 mm) or less in width that are used to finish adjacent surfaces provided that all joints are completely supported by a framing member.

5.3.2.5 Kitchen cabinet doors, countertops, backsplashes, exposed bottoms, and end panels shall have a flame-spread index not exceeding 200.

Exception: Cabinet rails, stiles, mullions, and top strips.

5.3.2.6 Finished surfaces of plastic bathtubs, shower units, and tub or shower doors shall have a flame-spread index not exceeding 200.

5.3.3 Fire-Protective Requirements.

5.3.3.1 Materials used to surface the following areas shall be limited-combustible materials [e.g., $\frac{5}{16}$ in. (8 mm) gypsum board]:

- (1) Exposed wall adjacent to the cooking range (See 5.3.2.4.)
- (2) Exposed bottoms and sides of kitchen cabinets, as required by Section 5.4
- (3) Interior walls and ceilings enclosing furnace and/or water heater spaces
- (4) Combustible doors that provide interior or exterior access to furnace and/or water heater spaces

5.3.3.1.1 The surface of combustible doors shall be permitted to be interrupted for louvers ventilating the enclosure. However, the louvers shall not be constructed of a material of greater combustibility than the door itself (e.g., plastic louvers on a wooden door).

5.3.3.2 No burner of a surface cooking unit shall be closer than 12 horizontal in. (305 mm) to a window or an exterior door with glazing.

5.4 Kitchen Cabinet Protection.

5.4.1 The bottom and sides of combustible kitchen cabinets located over cooking ranges to a horizontal distance of 6 in. (152 mm) from the outside edge of the cooking range shall be protected with at least $\frac{5}{16}$ in. (8 mm) thick gypsum board or equivalent limited-combustible material.

Exception: 1 in. (25 mm) nominal framing members and trim shall be exempted from this requirement.

5.4.2 The cabinet area located over the cooking range or cooktops shall be protected by a metal hood (26-gauge sheet metal, 0.017 stainless steel, 0.024 aluminum, or 0.020 copper), with not less than a 3 in. (76 mm) eyebrow projecting horizontally from the front cabinet face. The $\frac{5}{16}$ in. (8 mm) thick gypsum board or equivalent limited-combustible material that is above the top of the hood shall be permitted to be supported by the hood. A $\frac{3}{8}$ in. (10 mm) enclosed air space shall be provided between the bottom surface of the cabinet and the gypsum board or equivalent material. The hood shall be at least as wide as the cooking range.

5.4.3 The 3 in. (76 mm) metal eyebrow required by 5.4.2 shall project from the front and rear cabinet faces when there is no adjacent surface behind the range, or $\frac{5}{16}$ in. (8 mm) thick gypsum board or equivalent limited-combustible material shall be extended to cover all exposed rear surfaces of the cabinet.

5.4.4 The metal hood required by 5.4.2 shall not be required where an oven of equivalent metal protection or a microwave cooking appliance meeting the requirements of UL 923, *Microwave Cooking Appliances*, is installed between the cabinet and the range, and all exposed cabinet surfaces are protected as described in 5.4.1.

5.4.5 When a manufactured home is designed for the future installation of a cooking range, the metal hood and cabinet protection required by 5.4.1 and 5.4.2 and the wall-surfacing protection behind the range required by Section 5.3 shall be installed in the factory.

5.4.6 Ranges shall have a vertical clearance above the cooking top of not less than 24 in. (610 mm) to the bottom of combustible cabinets.

5.5 Carpeting. Carpeting shall not be used in a space or compartment designed to contain only a furnace and/or water heater. Carpeting shall be permitted to be used in other areas where a furnace or water heater is installed, provided that it is not located under the furnace or water heater.

5.6 Fireblocking.

5.6.1* General. Fireblocking shall comply with Section 5.6. The integrity of all fireblocking materials shall be maintained.

5.6.2 Fireblocking Materials. Fireblocking shall consist of the materials listed in 5.6.2.1 through 5.6.2.4.

5.6.2.1 Minimum 1 in. (25 mm) nominal lumber, $\frac{23}{32}$ in. (18 mm) wood structural panel or $\frac{5}{16}$ in. (8 mm) thick gypsum board, or the equivalent, shall be allowed.

5.6.2.2 Mineral wool or unfaced glass fiber batts or blankets shall be allowed as fireblocking where the material fills the entire cross section of the concealed space to a minimum

height of 16 in. (406 mm) measured vertically. The mineral wool or unfaced glass fiber batts or blankets shall be installed so as to be retained securely in place.

5.6.2.3 Loose-fill insulation shall be allowed as fireblocking where it has been specifically tested in the form and manner intended for use to demonstrate its ability to remain in place and to retard the spread of fire and hot gases.

5.6.2.4 Other materials shall be allowed if listed or approved.

5.6.3 Fireblocking Locations.

5.6.3.1 Fireblocking shall be installed in concealed spaces of stud walls, partitions, and furred spaces at the floor and ceiling levels. Concealed spaces shall not communicate between floor levels. Concealed spaces shall not communicate between a ceiling level and a concealed roof area, or an attic space.

5.6.3.2 Fireblocking shall be installed at the interconnection of a concealed vertical space and a concealed horizontal space that occurs in the following:

- (1) Between a concealed wall cavity and the ceiling joists above
- (2) At soffits, drop ceilings, cover ceilings and similar locations

5.6.3.3 Fireblocking shall be installed around the openings for pipes, vents, and other penetrations in walls, floors, and ceilings of furnace and water heater spaces. Fireblocking shall completely fill the opening around the penetration or shall completely fill the cavity or concealed space into which the penetration is made. Pipes, vents, and other penetrations that cannot be moved freely within their openings shall be considered fireblocked. Materials used to fireblock heat-producing vent penetrations shall be non-combustible or limited-combustible types.

5.6.4 Draftstopping.

5.6.4.1 When there is usable space both above and below the concealed space of a floor/ceiling assembly, draftstops shall be installed so that the area of the concealed space does not exceed 1000 ft² (93 m²).

5.6.4.2 Draftstopping shall divide the concealed space into approximately equal areas.

5.6.4.3 Where the assembly is enclosed by a floor membrane above and a ceiling membrane below, draftstopping shall be provided in the floor/ceiling assemblies:

- (1) When the ceiling is suspended under the floor framing
- (2) When the floor framing is constructed of truss type open-web or perforated members

5.6.4.4 Draftstopping materials shall not be less than 3/8 in. (10 mm) gypsum board, 3/8 in. (10 mm) wood structural panels, 3/8 in. (10 mm) Type 2-M-W particleboard, or other approved materials adequately supported.

5.6.4.5 Draftstopping shall be installed parallel to the floor framing members.

5.6.4.6 The integrity of all draftstops shall be maintained.

5.7 Requirements for Thermal Insulating Materials.

5.7.1 Insulating Materials Other Than Foam Plastic.

5.7.1.1 General. Exposed and concealed thermal insulation materials, other than foam plastic, shall have a flame-spread index of 25 or less, and a smoke-developed index of 450 or less

when tested in accordance with NFPA 255, *Standard Method of Test of Surface Burning Characteristics of Building Materials*. Tested materials shall include any facings. Materials and methods complying with 5.7.1.1.1, 5.7.1.1.2, and 5.7.1.2 shall be accepted.

5.7.1.1.1 The flame-spread and smoke-developed limitations shall not apply to coverings and facings of insulation batts or blankets installed in concealed spaces where the facings are in substantial contact with the unexposed surface of wall, floor, or ceiling finish.

5.7.1.1.2 Cellulose loose-fill insulation that is not spray applied or self-supporting and that complies with 5.7.1.2 shall not be required to have a flame-spread index of 25 or less.

5.7.1.2 Loose-fill Insulation.

5.7.1.2.1 Loose-fill insulation, other than cellulose loose-fill insulation, that cannot be mounted in the NFPA 255 test apparatus without a screen or other artificial support, shall have a flame-spread index of 25 or less and a smoke-developed index of 450 or less when tested in accordance with CAN/ULC-S102.2-M88. Cellulose loose fill shall comply with 5.7.1.2.2.

5.7.1.2.2 Cellulose loose-fill insulation shall comply with, and each package shall be labeled in accordance with, CPSC, 16 CFR, Parts 1209 and 1404.

5.7.1.3 Attic Locations. Exposed insulation installed in attics on the floor or ceiling forming the lower boundary of the attic shall have a critical radiant flux of not less than 0.12 watt/cm² when tested in accordance with NFPA 253, *Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source*.

5.7.2 Foam Plastic.

5.7.2.1 General. Foam plastic thermal insulating materials shall not be used within the cavity of walls (not including doors) or ceilings or be exposed to the interior of the home unless one of the following conditions exists:

- (1) The foam plastic insulating material is protected by an interior finish of 5/16 in. (8 mm) thick gypsum board or equivalent limited-combustible material for all cavities where the material is to be installed.
- (2) The foam plastic is used as a sheathing or siding backer-board, and it has the following characteristics:
 - (a) Flame-spread index of 75 or less and a smoke-developed index of 450 or less (not including outer covering or sheathing)
 - (b) Does not exceed 3/8 in. (10 mm) in thickness
 - (c) Is separated from the interior of the manufactured home by a minimum of 2 in. (50 mm) of mineral fiber insulation or an equivalent thermal barrier
- (3) The foam plastic insulating material has been previously accepted by the regulatory agency for use in wall and/or ceiling cavities of manufactured homes, and the insulating material is installed in accordance with any restrictions imposed at the time of that acceptance.
- (4) The foam plastic insulating material has been tested as required for its location in wall and/or ceiling cavities in accordance with testing procedures described in the Illinois Institute of Technology Research Institute (IITRI) report J-6461, "Development of Mobile Home Fire Test Methods to Judge the Fire-Safe Performance of Foam Plastic," or other full-scale fire tests accepted by the regulatory agency, and it is installed in a manner consistent

with the way the material was installed in the foam plastic test module. The materials shall be capable of meeting the acceptance criteria required in 5.7.1.1 through 5.7.1.3 for their locations.

5.7.2.2 Wall Assemblies. The foam plastic system shall demonstrate equivalent or superior performance to the control module, as determined by the following:

- (1) Time it takes to reach flashover [1112°F (600°C)] in the upper part of the room
- (2) Time it takes to reach an oxygen (O₂) level of 14 percent (rate of O₂ depletion), a carbon monoxide (CO) level of 1 percent, a carbon dioxide (CO₂) level of 6 percent, and a smoke level of 0.26 optical density/meter measured at 5 ft (1.5 m) high in the doorway
- (3) Rate of change concentration for O₂, CO, CO₂, and smoke measured 3 in. (76 mm) below the top of the doorway

5.7.2.3 Ceiling Assemblies. A minimum of three valid tests of the foam plastic system and one valid test of the control module shall be evaluated to determine if the foam plastic system demonstrates equivalent or superior performance to the control module. Individual factors to be evaluated include intensity of cavity fire (temperature-time) and post-test damage.

5.7.2.4 Post-Test Damage Assessment for Wall and Ceiling Assemblies. The overall performance of each total system also shall be evaluated in determining the acceptability of a particular foam plastic insulating material.

5.7.3 All foam plastic thermal insulating materials used in manufactured housing shall have a flame-spread index of 75 or less (not including outer covering or sheathing) and a maximum smoke-developed index of 450.

5.8 Fire Warning Equipment.

5.8.1 General. Approved, single-station smoke alarms or smoke detectors shall be installed in a manufactured home as specified in Section 5.8. Smoke detection systems installed in conformance with *NFPA 72, National Fire Alarm Code*, shall be acceptable.

5.8.2 Installation. Smoke alarms and smoke detectors shall be installed in accordance with the manufacturers' listing and instructions and shall comply with the following parameters.

5.8.2.1 Flat Ceilings. Smoke alarms or smoke detectors mounted on a flat ceiling shall be located no closer than 4 in. (102 mm) from the adjoining wall surface.

5.8.2.2* Sloped Ceilings (Peaked Ceilings). Smoke alarms or smoke detectors mounted on a peaked ceiling shall be located within 36 in. (914 mm) horizontally of the peak, but not closer than 4 in. (102 mm) vertically to the peak.

5.8.2.3* Sloped Ceilings (Shed Ceilings). Smoke alarms or smoke detectors mounted on a sloped ceiling having a rise greater than 1 ft in 8 ft (1 m in 8 m) horizontally shall be located within 36 in. (914 mm) of the high side of the ceiling, but not closer than 4 in. (102 mm) from the adjoining wall surface.

5.8.2.4* Wall Mounting. Smoke alarms or smoke detectors mounted on walls shall be located not closer than 4 in. (102 mm) from the adjoining ceiling surface, not farther than 12 in. (305 mm) from the adjoining ceiling surface, and not farther from the adjoining ceiling than specified in the manufacturers' installation instructions.

5.8.2.5 Electrical Connection. Smoke alarms designed to receive their primary power from an alternating current power source shall be mounted on an electrical outlet box and connected by a permanent wiring method in accordance with this standard. There shall be no switches in the circuit between smoke alarms or smoke detectors and the overcurrent protective device of that circuit. Smoke alarms or smoke detectors shall not receive their power from a circuit that is protected by a ground-fault circuit-interrupter.

5.8.3 Location.

5.8.3.1 General Location. Single-station smoke alarms or smoke detectors shall be installed in the following locations:

- (1)*In all sleeping rooms.
- (2) Outside of each separate sleeping area. In home designs that do not permit compliance with the requirements of 5.8.3.2, the smoke alarm or smoke detector shall be permitted to be placed in a common area adjacent to the sleeping area.
- (3) On each additional story of the manufactured home.

5.8.3.2 Specific Location Requirements. Specific locations for smoke alarms or smoke detectors shall be as follows:

- (1) Smoke alarms or smoke detectors shall be located in areas where ambient conditions are within the limits specified by the manufacturer.
- (2)*Smoke alarms or smoke detectors installed within 20 ft (6.1 m) horizontal path of a cooking appliance shall be equipped with an alarm silencing means or shall be of the photoelectric type.
- (3) Smoke alarms or smoke detectors shall not be installed within 36 in. (914 mm) from a door to a bathroom or kitchen or the supply grille of a forced air heating or cooling system.
- (4)*A manufactured home designed for the future installation of a roof-mounted evaporative cooler or other equipment discharging conditioned air through a ceiling grille into the living area shall not have smoke alarms or smoke detectors installed within 36 in. (914 mm) horizontal path of the future discharge opening.
- (5) Where there are stairs leading to other occupied levels, a smoke alarm or smoke detector shall be located near the top of each stairway so that smoke rising in the stairway cannot be prevented from reaching the smoke alarm or smoke detector by an intervening door or obstruction. For stairways leading up from a basement, smoke alarms or smoke detectors shall be located on the basement ceiling near the entry to the stairs.
- (6) A manufactured home designed for installation over a basement shall be provided with a junction box for the installation and interconnection of the smoke alarms or smoke detectors, as required by Section 5.8.

5.8.4 Visible Notification Appliances. If provided, visible notification appliances installed for the hearing impaired shall comply with the following requirements. Visible notification appliances shall not be required to operate from a secondary power source.

- (1) Visible notification devices shall be installed that produce at least 110 cd at the pillow in sleeping rooms and 15 cd in all other spaces.
- (2) Visible notification appliances located on the ceiling over the bed and within 16 ft (4.88 m) of a sleeping occupant, having a light output rating of at least 177 cd, shall be acceptable.

- (3) Visible notification appliances in a sleeping room mounted more than 24 in. (610 mm) below the ceiling and within 16 ft (4.88 m) of the pillow, having a minimum rating of 110 cd, shall be acceptable.

5.8.5 Interconnection. Smoke alarms shall be interconnected such that the operation of any one smoke alarm shall cause the alarm to sound in all smoke alarms within the manufactured home.

5.8.6 Power Supplies.

5.8.6.1 Smoke alarms shall receive their primary power from one of the following:

- (1) An alternating current power source, along with a secondary battery source capable of operating the device for at least 7 days in the normal condition, followed by 4 minutes of alarm
- (2) A nonreplaceable primary battery capable of operating the device for at least 10 years, followed by 4 minutes of alarm, followed by a trouble alarm for 7 days

5.8.6.2 Smoke detectors shall be connected to central controls for power, signal processing, and activation of notification appliances.

5.8.7 Maintenance, Testing, and Information.

5.8.7.1 Following installation, smoke alarms shall be functionally tested in accordance with the alarm manufacturers' instructions.

5.8.7.2 Fire warning equipment shall be provided with a convenient means for testing its operation by the homeowner.

5.8.7.3 Home manufacturers shall provide specific smoke alarm or smoke detector manufacturer instructions to the following:

- (1) The manufactured home installer, homeowner, or other responsible parties for the inspection and testing of smoke alarms or smoke detectors during manufactured home installation
- (2) The homeowner, describing the operation, maintenance, method, and frequency of testing of the smoke alarms
- (3) The homeowner, that unless otherwise recommended by the manufacturer, smoke alarms shall be replaced when they fail to respond to tests. Smoke alarms shall not remain in service longer than 10 years from the date of installation
- (4) The homeowner, describing the installation requirements of smoke alarms or smoke detectors as required by 5.8.3.2(6)

5.8.8 Labeling and Listing. Smoke alarms or smoke detectors shall be listed and approved to standards that verify the required performance. Smoke alarms conforming to ANSI/UL 217, *Single and Multiple Station Smoke Alarms*; smoke detectors conforming to ANSI/UL 268, *Smoke Detectors for Fire Protective Signaling Systems*; and visible signaling appliances conforming to ANSI/UL 1971, *Signaling Devices for Hearing Impaired*, shall be considered acceptable.

5.9 Fire Testing. All fire testing conducted in accordance with this chapter shall be performed by nationally recognized testing laboratories with expertise in fire technology. In case of dispute, the regulatory agency shall determine if a particular agency is qualified to perform such fire tests.

5.10 Fire Sprinkler System.

5.10.1 This section establishes minimum requirements when a fire sprinkler system is installed in a manufactured home. Unless the authority having jurisdiction requires a fire sprinkler system for all detached one- and two-family dwellings, these requirements for sprinkler systems are voluntary.

5.10.2 When an automatic fire sprinkler system is installed in a manufactured home, it shall be designed, installed, and tested in accordance with NFPA 13D, *Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes*.

5.10.3 The manufacturer shall permanently affix the certificate shown in Figure 5.10.3 adjacent to the data plate.

5.10.4 Home manufacturers shall provide specific instructions to setup crews or other responsible parties for the inspection and testing of the fire sprinkler system during manufactured home setup. The manufacturer shall specify on the certificate required by 5.10.3 the minimum required water supply in both pressure (psi, bar) and flow (gpm, L/min).

5.10.5 Upon final connection at the home site of the fire sprinkler system to the water supply per the manufacturer's instructions, the adequacy of the water supply shall be verified, and the system shall be tested per NFPA 13D, *Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes*. The site installer shall insert its company name and address, along with the date, on the certificate, per 5.10.3.

5.10.6 Home manufacturers shall provide the homeowner with the following information describing the fire sprinkler system:

- (1) Equipment and specifications
- (2) Design information
- (3) Operation
- (4) Method and frequency of system testing
- (5) Proper fire sprinkler maintenance

5.11 Attached Garages.

5.11.1 When a manufactured home is constructed for the attachment of a site built garage, provision will be made to provide fire separation between the garage and the manufactured home.

5.11.1.1 As a minimum, the garage shall be separated from the dwelling unit and its attic by not less than ½ in. (13 mm) gypsum board applied to the garage side and the separation shall be continuous from the bottom of the floor to the underside of the roof deck. The design approval and the manufacturer's installation instructions shall include provision for equivalent vertical separation between the garage and the space below the manufactured home floor system.

5.11.2 Openings between the garage directly into a room designated for sleeping purposes shall not be permitted. Other openings between the garage and the manufactured home shall be equipped with solid wood doors not less than 1⅜ in. (35 mm) in thickness, solid or honeycomb steel doors not less than 1⅜ in. (35 mm) in thickness, or 20-minute fire-rated doors, and all doors shall be self-closing.

5.11.3 Ducts penetrating the walls or ceilings separating the manufactured home from the garage shall be constructed of a minimum No. 26 gauge steel or other approved material and shall have no openings in the garage.

NFPA RESIDENTIAL FIRE SPRINKLER SYSTEM CERTIFICATION AND INFORMATION

Note: This label contains important information about the fire sprinkler system installed in this structure.

Homeowner: Do not remove, alter, or cover this label.

GENERAL INFORMATION

(1) Name and address of home manufacturer: _____

Manufactured home serial number: _____

(2) Name and address of residential fire sprinkler system installer (factory installation if different from the home manufacturer):

Date of factory installation: _____

The residential fire sprinkler system installed in this dwelling is in compliance with NFPA 13D, *Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes*, in effect on the date of installation indicated above. This system has been verified through hydraulic analysis based on the operating characteristics of the specific components utilized.

Note: The manufactured home installer must complete testing required by NFPA 13D at the home site.

Warning: When necessary, replace components only with identical components or those determined to have equivalent performance characteristics with respect to flows and pressures.

SPRINKLERS INSTALLED IN THIS STRUCTURE

	Manufacturer	Model	Year	Temp. (°F)	Design Coverage	Required Flow Rate	
						Single Sprinkler	Multiple Sprinklers
1.	_____	_____	_____	_____	_____ ft × _____ ft	_____ gpm @ _____ psi	_____ gpm @ _____ psi
2.	_____	_____	_____	_____	_____ ft × _____ ft	_____ gpm @ _____ psi	_____ gpm @ _____ psi
3.	_____	_____	_____	_____	_____ ft × _____ ft	_____ gpm @ _____ psi	_____ gpm @ _____ psi

MINIMUM WATER SUPPLY REQUIRED

Warning: For this system to operate properly, the following minimum supply of water must be available at the point of connection to the residential fire sprinkler system:

_____ gpm @ not less than _____ psi for not less than _____ minutes

The fire sprinkler system has been completed on site in accordance with the home manufacturer's installation instructions, and the above listed required water supply is available.

Name and address of site installer: _____ Date: _____

CONTROL VALVES

Warning: This structure contains a residential fire sprinkler system. Do not alter or make additions to the water supply without first contacting the home manufacturer.

The **control valve(s)** on the water supply to the residential fire sprinkler system must be in the **full open position** for the system to operate properly. If the valves must be closed temporarily to service the system, **notify local authorities having jurisdiction** and verify that they are **left fully open** and secured when service is complete.

FIGURE 5.10.3 Fire Sprinkler System Certification and Information for Manufactured Homes.

Chapter 6 Body and Frame Construction Requirements

6.1 Scope. This chapter shall cover the minimum requirements for materials, products, equipment, and workmanship needed to ensure that the manufactured home will provide the following:

- (1) Structural strength and rigidity
- (2) Protection against corrosion, decay, insects, rodents, and other similar destructive forces
- (3) Protection against hazards of windstorm
- (4) Resistance to the elements
- (5) Durability and economy of maintenance

6.2 Definitions. The following definitions shall be applicable to Chapter 6 only.

6.2.1 Anchoring Equipment. Straps, cables, turnbuckles, and chains, including tensioning devices, that are used with ties to secure a manufactured home to ground anchors.

6.2.2 Anchoring System. A combination of ties, anchoring equipment, and ground anchors that will, when properly designed and installed, resist overturning and lateral movement of the manufactured home from wind forces.

6.2.3 Footing. That portion of the support system that transmits loads directly to the soil.

6.2.4 Ground Anchor. Any device at the manufactured home stand designed to transfer manufactured home anchoring loads to the ground.

6.2.5 Load.

6.2.5.1 Dead Load. The weight of all permanent construction, including walls, floors, roof, partitions, and fixed service equipment.

6.2.5.2 Live Load. The weight superimposed by the use and occupancy of the manufactured home.

6.2.5.3 Wind Load. The lateral or vertical pressure or uplift on the manufactured home due to wind blowing in any direction.

6.2.6 Main Frame. The structural component on which the body of the manufactured home is mounted.

6.2.7 Pier. That portion of the support system between the footing and the manufactured home, exclusive of caps and shims.

6.2.8 Sheathing. Material that is applied on the exterior side of a building frame under the exterior weather-resistant covering.

6.2.8.1 Wood Structural Panel. A panel manufactured from veneers; or wood strands or wafers; or a combination of veneer and wood strands or wafers bonded together with waterproof synthetic resins or other suitable bonding systems, including composite panels, oriented strand board, and plywood. [5000:3.3.389.3]

6.2.8.1.1 Composite Wood Structural Panel. A structural panel that is made of layers of veneer and wood-based material. [5000:3.3.389.3.1]

6.2.8.1.2 Oriented Strand Board (OSB) Wood Structural Panel. A mat-formed wood structural panel product composed of thin, rectangular wood strands or wafers arranged in

oriented layers and bonded with waterproof adhesive. [5000:3.3.389.3.2]

6.2.8.1.3 Plywood Wood Structural Panel. A wood structural panel comprised of plies of wood veneer arranged in cross-aligned layers. [5000:3.3.389.3.3]

6.2.9 Stabilizing Devices. All components of the anchoring and support systems, including piers, footings, ties, anchoring equipment, ground anchors, and any other equipment that supports the manufactured home and secures it to the ground.

6.2.10 Support System. A combination of footings, piers, caps, and shims that will, when properly installed, support the manufactured home.

6.2.11 Tie. Straps, cable, or securing devices used to connect the manufactured home to ground anchors.

6.2.11.1 Diagonal Tie. A tie intended to primarily resist horizontal forces, but which also can be used to resist vertical forces.

6.2.11.2 Vertical Tie. A tie intended to resist uplifting or overturning forces.

6.3 General Requirements.

6.3.1 Minimum Requirements. The design and construction of a manufactured home shall conform with the provisions of this standard. Requirements for any size, weight, or quality of material modified by the terms “of minimum,” “not less than,” “at least,” and similar expressions, are minimum standards. The manufacturer or installer shall be permitted to exceed these standards, provided such deviation does not result in any inferior installation or defeat the purpose and intent of this standard.

6.3.2 Construction. All construction methods shall be in conformance with accepted engineering practices to ensure durable, livable, and safe housing and shall demonstrate acceptable workmanship that reflects a journeyman quality of work.

6.3.3 Structural Analysis. The strength and rigidity of the component parts and/or the integrated structure shall be determined by engineering analysis or by suitable load tests to simulate the actual loads and conditions of application that can occur. (See Chapters 7 and 12.)

6.3.4 New Materials and Methods.

6.3.4.1 Any new material or method of construction not provided for in this standard and any material or method of questioned suitability proposed for use in the manufacture of the structure shall nevertheless conform in performance to the requirements of this standard.

6.3.4.2 Unless based on accepted engineering design for the use indicated, all new manufactured home materials, equipment, systems, or methods of construction not provided for in this standard shall be subjected to the tests specified in 6.3.6.

6.3.5 Allowable Design Stress. The design stresses of all materials shall conform to accepted engineering practices. The use of materials not certified with a strength or stress grade shall be limited to the minimum allowable stresses under accepted engineering practices.

6.3.6 Alternate Test Procedures. In the absence of recognized testing procedures either in these standards or the applicable provisions of those standards incorporated by reference, the

manufacturer shall develop or cause to be developed testing procedures to demonstrate the structural properties and significant characteristics of the material, assembly, subassembly component, or member. Such testing procedures shall become part of the manufacturer's approved design.

6.3.6.1 Such tests shall be witnessed by an independent, licensed, professional engineer or architect or by a recognized testing organization.

6.3.6.2 Copies of the test results shall be kept on file by the manufactured home manufacturer.

6.4 Minimum Standards. Structural design and construction in manufactured homes shall conform to applicable standards in Table 6.4 unless otherwise specified in this standard. When more than one standard is referenced, compliance with any one such standard shall meet the requirements of this standard.

Table 6.4 Materials and Methods for Construction

Materials	Reference Standards
Steel	
<i>Specification for Structural Steel Buildings — Allowable Stress Design and Plastic Design</i> (The following parts of this reference standard shall not be applicable: 1.3.3, 1.3.4, 1.3.5, 1.3.6, 1.4.6, 1.5.1.5, 1.5.5, 1.6, 1.7, 1.8, 1.9, 1.10.4 through 1.10.7, 1.10.9, 1.11, 1.13, 1.14.5, 1.17.7 through 1.17.9, 1.19.1, 1.19.3, 1.20, 1.21, 1.23.7, 1.24, 1.25.1 through 1.25.5, 1.26.4, 2.3, 2.4, 2.8 through 2.10.)	AISC-ASD, 1989
<i>Cold-formed Steel Design Manual</i> (The following parts of this reference standard shall not be applicable: 3.1.2, 4.2.1, 4.2.4.)	AISI-SG 673, 1986 edition, with 1989 addendum
<i>Standard Specification for Strapping, Flat Steel, and Seals</i>	ASTM D 3953-97
Wood and Wood Products	
<i>Basic Hardboard</i>	ANSI/AHA A 135.4-1995
<i>Prefinished Hardboard Paneling</i>	ANSI/AHA A 135.5-1995
<i>Hardboard Siding</i>	ANSI/AHA A 135.6-1998
<i>Hardwood and Decorative Plywood</i>	ANSI/HPVA HP-1-2000
<i>Structural Design Guide for Hardwood Plywood</i>	HPVA HP-SG-96
<i>Voluntary Product Standard PS 1-95, Construction and Industrial Plywood</i>	USDOC PS-1-95
<i>Voluntary Product Standard PS 2-92, Performance Standard for Wood-Based Structural-Use Panels</i>	USDOC PS-2-92
<i>Engineered Wood Construction Guide</i>	APA E-30S-2003
<i>Design and Fabrication of All-Plywood Beams, Supp. 5</i>	APA H-815E-1995
<i>Plywood Design Specification</i>	APA Y-510T-1999
<i>Design and Fabrication of Glued Plywood-Lumber Beams, Supp. 2</i>	APA S-812R-1998
<i>Design and Fabrication of Plywood Sandwich Panels, Supp. 4</i>	APA U-814H-1993
<i>PRP-108, Performance Standards and Policies for Structural Use Panels</i>	APA E445S-2002
<i>Design and Fabrication of Plywood Stressed-Skin Panels, Supp. 3</i>	APA U-813L-1996
<i>Design Capacities of APA Performance Rated Structural-Use Panels</i>	APA N 375B-2001
<i>Allowable Stress Design (ASD) Manual for Engineered Wood Construction, including:</i>	AFPA T101-01
<i>ANSI/AF&PA National Design Specification® (NDS®) for Wood Construction, 2001 Edition</i>	
<i>NDS® Supplement: Design Values for Wood Construction, 2001 Edition</i>	
<i>ASD Manual for Engineered Wood Construction, 2001 Edition</i>	
<i>ASD/LRFD Special Design Provisions for Wind and Seismic, 2001 Edition</i>	
<i>ASD Supplement: Structural Lumber, 2001 Edition</i>	
<i>ASD Supplement: Structural Glued Laminated Timber, 2001 Edition</i>	
<i>ASD Supplement: Wood Structural Panels, 2001 Edition</i>	
<i>ASD Supplement: Timber Poles and Piles, 2001 Edition</i>	
<i>ASD Supplement: Wood Structural Panel Shear Wall and Diaphragm, 2001 Edition</i>	
<i>ASD Guideline: Metal Plate Connected Wood Trusses, 2001 Edition</i>	

Table 6.4 *Continued*

Materials	Reference Standards
<i>ASD Guideline: Pre-Engineered Metal Connectors</i> , 2001 Edition	
<i>ASD Guideline: Structural Composite Lumber</i> , 2001 Edition	
<i>ASD Guideline: Wood I-Joists</i> , 2001 Edition	
<i>Wood Structural Design Data</i> , 1986 edition with 1992 revisions	AFPA T05
<i>American Softwood Lumber Standard</i>	USDOC PS-20-99
<i>Span Tables for Joists and Rafters</i>	AFPA T03-93
<i>Specifications for Metal Plate Connected Wood Trusses</i>	TPI-95
<i>Mat-formed Wood Particleboard</i>	ANSI A 208.1-1999
<i>Architectural and Wood Flush Doors</i>	ANSI/WDMA I.S.1-A-97
<i>Voluntary Specifications for Aluminum, Vinyl, PVC, and Wood Windows and Glass Doors</i>	ANSI/AAMA/WDMA 101/I.S.2-97
<i>Water-Repellent Preservative Non-Pressure Treatment for Millwork</i>	WDMA I.S.4-00
<i>Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials</i>	ASTM D 4442-92 (1997)
<i>Standard Test Methods for Use and Calibration of Hand-Held Moisture Meters</i>	ASTM D 4444-92 (1998)
<i>Medium Density Fiberboard for Interior Use (MDF)</i>	ANSI A 208.2-94
Other	
<i>Standard Specification for Gypsum Wallboard</i>	ASTM C 36-01
<i>Residential Asphalt Roofing Manual</i>	ARMA 1997
Fasteners	
<i>Power-Driven Staples and Nails for Use in All Types of Building Construction</i>	NER-272-97
Unclassified	
<i>Minimum Design Loads for Buildings and Other Structures</i>	SEI/ASCE 7-02
<i>Performance Standard for Wood-Based Structural-Use Panels</i>	USDOC PS-2-92
<i>Safety Performance Specifications and Methods of Test for Safety Glazing Materials Used in Building</i>	ANSI Z 97.1-1984

6.4.1 Dimension and board lumber shall not exceed 19 percent moisture content at time of installation.

6.4.2 Materials and methods of construction utilized in the design and construction of manufactured homes that are covered by the standards in Table 6.4, or any applicable portion thereof, shall comply with the requirements of this standard.

6.4.3 Engineering analysis and testing methods contained in the references in Table 6.4 shall be utilized to judge conformance with accepted engineering practices required in 6.3.3.

6.4.4 Materials and methods of installation conforming to the standards in Table 6.4 shall be considered acceptable when installed in conformance with the requirements of Chapter 6.

6.4.5 Materials meeting the standards in Table 6.4 (or the applicable portion thereof) shall be considered acceptable unless otherwise specified herein or substantial doubt exists as to conformance.

6.4.6 Wood products shall be identified as complying with the appropriate standards in Table 6.4.

6.5 Structural Design Requirements.

6.5.1 General. Each manufactured home shall be designed and constructed as a completely integrated structure capable of sustaining the design load requirements of this standard, and shall be capable of transmitting these loads to stabilizing

devices without exceeding the allowable stresses or deflections. Roof framing shall be securely fastened to wall framing, walls to floor structure, and floor structure to chassis to secure and maintain continuity between the floor and chassis, so as to resist wind overturning, uplift, and sliding as imposed by design loads in this part. In multistory construction, each story shall be securely fastened to the story above and/or below to provide continuity and resist design loads in this part. Uncompressed finished flooring greater than 1/8 in. (3 mm) in thickness shall not extend beneath load-bearing walls that are fastened to the floor structure.

6.5.2 Design Loads.

6.5.2.1 Design Dead Loads. Design dead loads shall be the actual dead load supported by the structural assembly under consideration.

6.5.2.2 Design Live Loads. The design live loads and wind and snow loads shall be as specified in Section 6.5 and shall be considered to be uniformly distributed. The roof live load or snow load shall not be considered as acting simultaneously with the wind load, and the roof live or snow load and floor live loads shall not be considered as resisting the overturning moment due to wind.

6.5.2.3 When engineering calculations are performed, allowable unit stresses shall be permitted to be increased as provided in the documents referenced in Table 6.4, except as otherwise indicated in 6.4.2 and 6.6.1.

6.5.2.4 Whenever the roof slope does not exceed 20 degrees, the design horizontal wind loads required by 6.5.3.1 shall be permitted to be determined without including the vertical roof projection of the manufactured home. However, regardless of the roof slope of the manufactured home, the vertical roof projection shall be included when determining the wind loading for split level or clerestory-type roof systems.

6.5.3 Wind, Snow, and Roof Loads.

6.5.3.1 Wind Loads — Design Requirements. The manufactured home, each of its wind-resisting parts (including, but not limited to, shear walls, diaphragms, ridge beams, and their fastening and anchoring systems), and its components and cladding materials (including, but not limited to, roof trusses, wall studs, exterior sheathing, roofing and siding materials, exterior glazing, and their connections and fasteners) shall be designed by a professional engineer or architect to resist the following:

- (1) The design wind pressures for Exposure C specified in SEI/ASCE 7-02, *Minimum Design Loads for Buildings and Other Structures*, a design wind speed of 90 mph (145 km/hr) for Wind Zone I; 110 mph (177 km/hr), as specified for Wind Zone II; 130 mph (210 km/hr), as specified for Wind Zone III; or 150 mph (242 km/hr), as specified for Wind Zone IV [see Figure 6.5.3.1(a)].
- (2) Not more than 60 percent of the dead load of the structure shall be permitted to be used to resist the wind pressures in Table 6.5.3.1.

6.5.3.2 Wind Loads — Zone Designations. The wind zone and specific wind design load requirements shall be determined by the fastest basic wind speed (mph or km/hr) within each zone and the intended location, based on Figure 6.5.3.1(a).

6.5.3.2.1 Wind Zone I — 90 mph (145 km/hr). Wind Zone I shall consist of those areas shown in Figure 6.5.3.1(a) that are not identified in 6.5.3.2.2, 6.5.3.2.3, or 6.5.3.2.5 as being within Wind Zone II, Wind Zone III, or Wind Zone IV, respectively.

6.5.3.2.2 Wind Zone II — 110 mph (177 km/hr). The following areas listed by state and county or city shall be deemed to be within Wind Zone II in accordance with Figure 6.5.3.1(a):

- (1) Alabama — Autauga, Barbour, Bibb, Bullock, Butler, Chambers, Chilton, Choctaw, Clarke, Coffee, Conecuh, Coosa, Covington, Crenshaw, Dale, Dallas, Elmore, Escambia, Geneva, Greene, Hale, Henry, Houston, Lee, Lowndes, Macon, Marengo, Monroe, Montgomery, Perry, Pike, Russell, Sumter, Tallapoosa, Washington, Wilcox
- (2) Connecticut — Fairfield, Hartford, Litchfield, New Haven, Tolland, Windham
- (3) Delaware — Kent, Sussex
- (4) Florida — Alachua, Baker, Bradford, Clay, Columbia, De Soto, Gadsden, Gilchrist, Glades, Hamilton, Hardee, Highlands, Jefferson, Lafayette, Lake, Leon, Madison, Marion, Orange, Osceola, Putnam, Polk, Seminole, Sumter, Suwannee, Union
- (5) Georgia — Appling, Atkinson, Bacon, Baker, Baldwin, Ben Hill, Berrien, Bibb, Bleckley, Brantley, Brooks, Bulloch, Burke, Calhoun, Candler, Charlton, Chattahoochee, Clay, Clinch, Coffee, Colquitt, Columbia, Cook, Crawford, Crisp,

Decatur, Dodge, Dooly, Dougherty, Early, Echols, Effingham, Emanuel, Evans, Glascock, Grady, Hancock, Harris, Houston, Irwin, Jeff Davis, Jefferson, Jenkins, Johnson, Jones, Lamar, Lanier, Laurens, Lee, Long, Lowndes, Macon, Marion, McDuffie, Meriwether, Miller, Mitchell, Monroe, Montgomery, Muscogee, Peach, Pierce, Pike, Pulaski, Quitman, Randolph, Richmond, Schley, Screven, Seminole, Stewart, Sumter, Talbot, Tattnall, Taylor, Telfair, Terrell, Thomas, Tift, Toombs, Treutlen, Troup, Turner, Twiggs, Upson, Ware, Warren, Washington, Wayne, Webster, Wheeler, Wilcox, Wilkinson, Worth

- (6) Hawaii — the entire state
- (7) Louisiana — Parishes of Acadia, Allen, Ascension, Avoyelles, Beauregard, Calcasieu, Catahoula, Concordia, East Baton Rouge, East Feliciana, Evangeline, Iberville, Jefferson Davis, Livingston, Pointe Coupee, Rapides, St. Helena, St. Landry, St. Martin, Tangipahoa, Vermilion, Vernon, Washington, West Baton Rouge, West Feliciana
- (8) Maine — Androscoggin, Cumberland, Hancock, Kennebec, Knox, Lincoln, Sagadahoc, Waldo, York
- (9) Maryland — Caroline, Dorchester, Queen Annes, Talbot, Wicomico
- (10) Massachusetts — Bristol, Essex, Franklin, Hampden, Hampshire, Middlesex, Norfolk, Suffolk, Worcester
- (11) Mississippi — Adams, Amite, Claiborne, Clarke, Copiah, Covington, Forrest, Franklin, Hinds, Jasper, Jefferson, Jefferson Davis, Jones, Kemper, Lamar, Lauderdale, Lawrence, Leake, Lincoln, Marion, Neshoba, Newton, Noxubee, Pike, Rankin, Scott, Simpson, Smith, Walthall, Wayne, Wilkinson, Winston
- (12) New Hampshire — Cheshire, Hillsborough, Merrimack, Rockingham, Strafford
- (13) New Jersey — Bergen, Burlington, Camden, Cumberland, Essex, Gloucester, Hudson, Mercer, Middlesex, Monmouth, Morris, Passaic, Salem, Somerset, Union
- (14) New York — Bronx, Kings, New York, Putnam, Queens, Richmond, Rockland, Westchester
- (15) North Carolina — Bertie, Bladen, Cumberland, Duplin, Edgecombe, Gates, Greene, Halifax, Harnett, Hertford, Hoke, Johnston, Lenoir, Martin, Nash, Northampton, Pitt, Robeson, Sampson, Scotland, Wayne, Wilson
- (16) Pennsylvania — none
- (17) Rhode Island — Providence
- (18) South Carolina — Aiken, Allendale, Bamberg, Barnwell, Berkeley, Calhoun, Chesterfield, Clarendon, Colleton, Darlington, Dillon, Dorchester, Fairfield, Florence, Hampton, Jasper, Kershaw, Lancaster, Lee, Lexington, Marion, Marlboro, Orangeburg, Richland, Sumter, Williamsburg
- (19) Texas — Angelina, Atascosa, Austin, Bastrop, Bee, Brooks, Burleson, Caldwell, Colorado, De Witt, Duval, Fayette, Fort Bend, Goliad, Gonzales, Grimes, Guadalupe, Hardin, Harris, Hidalgo, Jackson, Jasper, Jim Hogg, Jim Wells, Karnes, Lavaca, Lee, Liberty, Live Oak, McMullen, Montgomery, Newton, Orange, Polk, San Jacinto, Starr, Trinity, Tyler, Victoria, Walker, Waller, Washington, Webb, Wharton, Wilson, Zapata
- (20) Virginia — The counties of Gloucester, Isle of Wight, James City, Lancaster, Mathews, Middlesex, Northumberland, Southampton, Surry, York; the cities of Chesapeake, Hampton, Newport News, Norfolk, Portsmouth, Suffolk, Virginia Beach, Williamsburg



6.5.3.2.3 Wind Zone III — 130 mph (210 km/hr). The following areas shall be considered to be within Wind Zone III in accordance with Figure 6.5.3.1(a):

- (1) States and Territories. The following states and territories:
 - (a) The coastal regions of Alaska (as determined by the 110 mph isotach on the SEI/ASCE 7-02 map)
 - (b) American Samoa
- (2) Local Governments. The following local governments are listed by state and county:
 - (a) Alabama — Baldwin, Mobile
 - (b) Connecticut — Middlesex, New London
 - (c) Florida — Bay, Brevard, Calhoun, Charlotte, Citrus, Collier, DeSoto, Dixie, Duval, Escambia, Flagler, Franklin, Gulf, Hendry, Hernando, Hillsborough, Holmes, Indian River, Jackson, Lee, Levy, Liberty, Manatee, Nassau, Okaloosa, Okeechobee, Pasco, Pinellas, Santa Rosa, Sarasota, St. Johns, St. Lucie, Taylor, Volusia, Wakulla, Walton, Washington
 - (d) Georgia — Bryan, Camden, Chatham, Glynn, Liberty, McIntosh
 - (e) Louisiana — Parishes of Assumption, Iberia, Lafayette, Orleans, St. Charles, St. James, St. John the Baptist, St. Martin, St. Tammany
 - (f) Maryland — Somerset, Worcester
 - (g) Massachusetts — Barnstable, Bristol, Dukes, Nantucket, Plymouth
 - (h) Mississippi — George, Greene, Hancock, Harrison, Pearl River, Perry, Stone
 - (i) New Jersey — Atlantic, Cape May, Ocean
 - (j) New York — Nassau, Suffolk
 - (k) North Carolina — Beaufort, Camden, Chowan, Columbus, Craven, Currituck, Dare, Hyde, Jones, New Hanover, Onslow, Pamlico, Pasquotank, Pender, Perquimans, Tyrrell, Washington
 - (l) Rhode Island — Bristol, Kent, Newport, Washington
 - (m) South Carolina — Beaufort, Charleston, Georgetown, Horry
 - (n) Texas — Brazoria, Calhoun, Chambers, Galveston, Jefferson, Kenedy, Kleberg, Matagorda, Nueces, Refugio, San Patricio, Willacy
 - (o) Virginia — Accomack, Northampton

Table 6.5.3.1 Design Wind Pressures Anchorage for Lateral and Vertical Stability

Basic Wind Speed	Main Wind Force Resisting System ^a						
	Load Direction	Roof Pitch	Horizontal Pressure (psf)		Vertical Pressure (psf)		
			Wall	Roof	Windward	Leeward	Windward Overhang
Wind Zone I — 90 mph (145 km/hr)	Transverse	≤3:12	13.8	-4.2	-13.9	-9.6	-21.4
		5:12	15.2	0.0	-10.1	-10.1	-17.6
		≥7:12 ^b	14.4	10.0	5.9	-9.3	-6.9
	Longitudinal	Singlewide Multiwide	12.9 11.6	-6.5 -5.6	-15.8 -14.3	-9.4 -8.8	-23.3 -21.8
Wind Zone II — 110 mph (177 km/hr)	Transverse	≤3:12	20.5	-6.3	-20.8	-14.4	-32.0
		5:12	22.7	0.0	-15.1	-15.1	-26.3
		≥7:12 ^b	21.6	14.8	8.9	-14.0	-10.3
	Longitudinal	Singlewide Multiwide	19.3 17.4	-9.6 -8.4	-23.7 -21.6	-14.1 -13.1	-34.9 -32.7
Wind Zone III — 130 mph (210 km/hr)	Transverse	≤3:12	28.7	-8.8	-29.0	-20.2	-44.6
		5:12	31.8	0.0	-21.0	-21.1	-36.7
		≥7:12 ^b	30.2	20.8	12.5	-19.6	-14.5
	Longitudinal	Singlewide Multiwide	27.0 24.2	-13.4 -11.6	-33.1 -30.1	-19.7 -18.4	-48.7 -45.7
Wind Zone IV — 150 mph (242 km/hr)	Transverse	≤3:12	38.2	-11.8	-38.6	-26.8	-59.4
		5:12	42.2	0.0	-28.1	-28.0	-48.9
		≥7:12	40.2	27.6	16.6	-26.0	-19.2
	Longitudinal	Singlewide Multiwide	36.0 32.3	-17.9 -15.6	-44.0 -40.0	-26.2 -24.6	-64.8 -60.8

Table 6.5.3.1 *Continued*

Components and Cladding								
	Wind Zone I — 90 mph (145 km/hr) (psf)		Wind Zone II — 110 mph (177 km/hr) (psf)		Wind Zone III — 130 mph (210 km/hr) (psf)		Wind Zone IV — 150 mph (242 km/hr) (psf)	
Walls ^c								
Walls interior zone	17.7	−19.1	26.4	−28.6	36.8	−39.9	49.0	−53.1
Walls within 3 ft of corners	17.7	−23.6	26.4	−35.2	36.8	−49.2	49.0	−65.6
Roofs — Slopes up to and including 6:12 ^d								
Roof interior zone (z−1)	10.2	−16.1	15.1	−24.1	21.2	−33.6	28.2	−44.8
Within 3 ft of roof edge (z−2)	10.2	−28.2	15.1	−42.1	21.2	−56.8	28.2	−78.2
Within 3 ft of roof corners (z−3)	10.2	−41.6	15.1	−62.2	21.2	−86.9	28.2	−115.7
Roof overhang int. (z−2)		−32.9		−49.1		−68.6		−91.4
Roof overhang corner (z−3)		−55.3		82.6		−115.3		−153.5
Roofs — Slopes greater than 6:12 ^d								
Roof interior zone (z−1)	16.1	−17.7	24.1	−26.4	33.6	−37.3	44.8	−49.0
Within 3 ft of roof edge (z−2)	16.1	−20.6	24.1	−30.9	33.6	−43.1	44.8	−57.2
Within 3 ft of roof corners (z−3)	16.1	−20.6	24.1	−30.9	33.6	−43.1	44.8	−57.2
Roof overhang interior (z−2)		−29.9		−44.6		−62.3		−83.0
Roof overhang corner (z−3)		−29.9		−44.6		−62.3		−83.0

For SI units, 1 psf = 0.04788 kN/m².

Notes:

(1) Plus sign (+) means pressures are acting toward or on the structure; minus sign (-) means pressures are acting away from the structure; plus-minus sign (±) means pressures can act in either direction, toward or away from the structure.

(2) See 6.6.1 for provisions for support and anchoring systems.

(3) Pressures shown are applied to the horizontal and vertical projections, for Exposure C, and a mean roof height of 15 ft (4.5 m). For a roof height of 25 ft (7.6 m), multiply the table values by 1.11.

(4) Design values in this table are applicable only to roof slopes between 10 degrees (nominal 2:12 slope) and 45 degrees (nominal 12:12 slope). For roof slopes between those shown, linear interpolation shall be permitted.

(5) The design uplift pressures are the same whether they are applied normal to the surface of the roof or to the horizontal projection of the roof.

(6) Shingle roof coverings that are secured with six fasteners per shingle through an underlayment that is cemented to a ⅜ in. (10 mm) structural rated roof sheathing need not be evaluated for the design wind pressures of Wind Zone II, III, or IV.

(7) Structural rated roof sheathing that is at least ⅜ in. (10 mm) in thickness, installed with the long dimension perpendicular to roof framing supports, and secured with fasteners at 4 in. (102 mm) on center within 3.0 ft (0.9 m) of each gable end or endwall if no overhanging is provided, and 6 in. (152 mm) on center in all other areas, need not be evaluated for the design wind pressures of Wind Zone II, III, or IV.

(8) Exterior coverings that are secured at 6 in. (152 mm) on center to a ⅜ in. (10 mm) structural rated sheathing that is fastened to wall framing members at 6 in. (152 mm) on center need not be evaluated for the design wind pressures of Wind Zone II, III, or IV.

(9) One-piece metal roofings, tested without structural sheathing, using the design wind pressures specified in the table for components and cladding (exterior roof coverings), are allowed to be used without structural sheathing.

(10) The edge distance shall be equal to 2a, where for widths of 30 ft (9 m) or less, a = 3 ft (0.9 m), and for widths greater than 30 ft (9 m), a = 10 percent of the least horizontal dimension, or 0.4 times the mean roof height, whichever is smaller, but not less than either 4 percent of the least horizontal dimension or 3 ft (0.9 m).

(11) Components and cladding include roof trusses, exterior roof coverings, sheathing and fastening; wall studs; exterior windows and sliding glass doors (glazing and framing); and exterior coverings, sheathings and fastening.

^aMain wind force resisting system includes shearwalls, diaphragms, their fastening and anchorage systems, ridge beams, and other main roof support beams (beams supporting expanding room sections, etc.).

^bThe total horizontal load shall not be less than that determined by assuming the horizontal roof projections are equal to zero.

^cFor sliding glass doors with opening widths of 72 in. (1.82 m) or greater, the pressures in the table may be multiplied by 0.92.

^dSee Figure 6.5.3.1 (b) for explanation of roof zones.

6.5.3.2.4 Wind Zone IV – 150 mph (242 km/hr). The following areas shall be considered to be within Wind Zone IV in accordance with Figure 6.5.3.1(a):

- (1) The following territories: all of the U.S. Territories of Guam, Northern Mariana Islands, Puerto Rico, Trust Territory of the Pacific Islands, and the United States Virgin Islands
- (2) The following local governments are listed by state and county:
 - (a) Florida — Broward, Martin, Miami-Dade, Monroe, Palm Beach
 - (b) Louisiana — Parishes of Cameron, Lafourche, Plaquemines, St. Bernard, St. Mary, Terrebonne, Vermilion
 - (c) Mississippi — Jackson
 - (d) North Carolina — Brunswick, Carteret
 - (e) Texas — Cameron

6.5.3.2.5 Local Requirements. For areas where recognized wind mapping data indicate wind speeds in excess of those identified in this standard, the federal regulatory agency shall consider processing through rule making for the purpose of adopting more stringent requirements of the state and local area.

6.5.3.3 Snow and Roof Loads.

6.5.3.3.1 Flat, curved, and pitched roofs shall be designed to resist the live loads shown in Table 6.5.3.3.1 and Figure 6.5.3.3.1, based on the roof load zone areas established in 6.5.3.3.1.1 through 6.5.3.3.1.3, applied downward on the horizontal projection as appropriate for the design zone marked on the manufactured home.

6.5.3.3.1.1* Middle Roof Load Zone. The counties in each state shown in Table 6.5.3.3.1.1 shall be deemed to be within the Middle Roof Load Zone.

Table 6.5.3.3.1.1 Middle Roof Load Zones

State	Counties				
Colorado	All counties				
Idaho	All counties				
Iowa	Hancock Lyon Osceola Dickinson Emmet Kossuth Winnebago	Mitchell Howard Chickasaw Butler Floyd Cerro Gordo Franklin	Hamilton Webster Calhoun Sac Ida Humboldt	Buena Vista Cherokee Plymouth Sioux O'Brien Clay	Hardin Worth Palo Alto Crawford Wright Pocahontas
Maine	Franklin Oxford	Kennebec Androscoggin	Lincoln Sagadahoc	Cumberland	York
Massachusetts	Essex				
Michigan	Houghton Baraga Marquette Alger Luce Chippewa Keweenaw	Iron Dickinson Menominee Delta Schoolcraft Mackinac Cheboygan	Presque Isle Charlevoix Montmorency Alpena Alcona Ogemaw Roscommon	Wexford Benzie Grand Traverse Kalkaska Oscoda Otsego	Gogebic Leelanau Antrim Missaukee Emmet Ontonagon

Table 6.5.3.3.1 Roof Load Zones

Zone	Pressure	
	psf	kPa
North zone	40	1.9
Middle zone	30	1.4
South zone	20	1.0

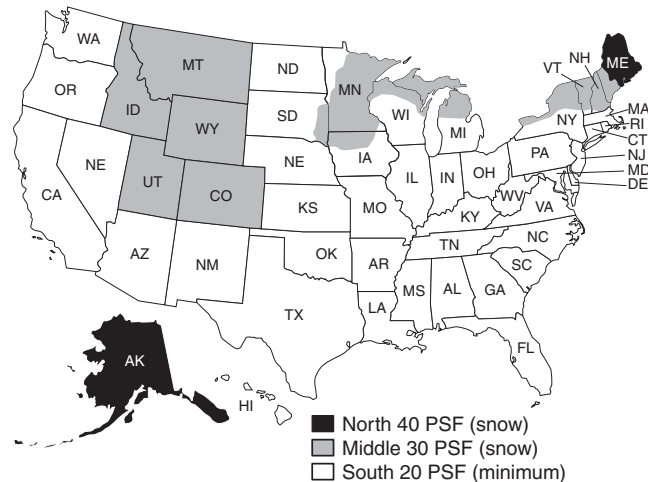


FIGURE 6.5.3.3.1 Roof Load Zone Map.

Table 6.5.3.3.1 *Continued*

State	Counties				
Minnesota	Koochiching Itasca Hubbard Cass Crow Wing Aitkin St. Louis Lake Cook Carlton Pine Wadena Todd Morrison	Stearns Swift Kandiyohi Meeker Wright Lac qui Parle Chippewa Yellow Medicine Mille Lacs Kanabec Benton Isanti Sherburne Anoka	Renville McLeod Carver Dakota Goodhue Wabasha Winona Fillmore Mower Olmsted Dodge Rice Steele Freeborn	Sibley Nicollet Blue Earth Martin Watsonwan Brown Redwood Lyon Lincoln Pipestone Murray Cottonwood Jackson Nobles	Scott Ramsey Pope Le Sueur Hennepin Stevens Grant Washington Waseca St. Croix Douglas Chisago Faribault Rock
Montana	All counties				
New Hampshire	Coos Grafton	Belknap Strafford	Sullivan Rockingham	Hillsborough Cheshire	Carroll Merrimack
New York	St. Lawrence Franklin Clinton Essex Hamilton Warren	Herkimer Lewis Oswego Jefferson Oneida Fulton	Onondaga Madison Cayuga Seneca Wayne Ontario	Genesee Orleans Niagara Erie Wyoming Monroe	Washington Schenectady Livingston Saratoga Montgomery Yates
South Dakota	Grant Codington Deuel Hamlin	Brookings Miner Lake Moody	Hanson Minnehaha Hutchinson Turner	Lincoln Yankton Union	Kingsbury McCook Clay
Utah	All counties				
Vermont	Franklin Grand Isle Orange	Orleans Essex Windsor	Caledonia Washington	Addison Rutland	Lamoille Chittenden
Wisconsin	Douglas Bayfield Ashland Iron Vilas Forest Florence	Oconto Menominee Langlade Marathon Clark Jackson Trempealeau	Pepin Pierce Dunn Eau Claire Chippewa Rusk	Lincoln Oneida Polk Burnett Washburn Sawyer	Marinette Buffalo Taylor Door Price Barron
Wyoming	All counties				

6.5.3.3.1.2* North Roof Load Zone. The following counties in each listed state shall be deemed to be within the North Roof Load Zone.

- (1) Maine — Aroostook, Piscataquis, Somerset, Penobscot, Waldo, Knox, Hancock, Washington
- (2) Alaska — All counties (i.e., boroughs)

6.5.3.3.1.3 South Roof Load Zone. The states and counties that are not listed for the Middle Roof Load Zone, 6.5.3.3.1.1, or the North Roof Load Zone, 6.5.3.3.1.2, shall be deemed to be within the South Roof Load Zone.

6.5.3.3.2 Eaves and cornices shall be designed for a net uplift pressure of 2.5 times the design uplift wind pressures cited in 6.5.3.1.

6.5.3.4 Consideration of Local Requirements. For exposures in areas (mountainous or other) where recognized snow records or wind records indicate significant differences from the loads stated in 6.5.3.3, the federal regulatory agency shall consider establishing more stringent requirements for homes known to be destined for such areas by proceeding through rule making for the purpose of adopting more stringent requirements for the local conditions.

For snow loads, such requirements shall be based on a snow load of 0.6 of the ground snow load for areas exposed to wind and a roof snow load of 0.8 of the ground snow load for sheltered areas.

6.5.3.5 Data Plate Requirements. The data plate posted in the manufactured home (see Section 1.5) shall designate the wind and roof load zones or, if designed for higher loads, the actual design external snow and wind loads for which the home has been designed. The data plate shall include reproductions of Figure 6.5.3.1(a) and Figure 6.5.3.3.1 with any related information. The load zone maps shall be not less than 3½ in. × 2¼ in. (89 mm × 57 mm).

6.5.4 Design Load Deflection.

6.5.4.1 When a structural assembly is subjected to total design loads, but not including dead load, the deflection for structural framing members shall not exceed the following (where L equals the clear span between supports or two times the length of a cantilever):

- (1) Floor — $L/240$
- (2) Roof and ceiling — $L/180$
- (3) Headers, beams, and girders (vertical load) — $L/180$
- (4) Walls and partitions — $L/180$

6.5.4.2 The allowable eave or cornice deflection for uplift shall be measured at the design uplift pressure cited in 6.5.3.1. The allowable deflection shall be $(2 \times L_c)/180$, where L_c is the measured horizontal eave projection from the wall.

6.5.5 Fastening of Structural Systems.

6.5.5.1 Roof framing shall be securely fastened to wall framing, walls to floor structure, and floor structure to chassis to secure and maintain continuity between the floor and chassis, so as to resist wind overturning, uplift, and sliding as specified in this section. In multistory construction, each story shall be securely fastened to the story above and/or below to provide continuity and resist design loads in this section. The number and type of fasteners used shall be capable of transferring all forces between elements being joined.

6.5.5.2 For Wind Zones II, III, and IV, roof framing members shall be securely fastened at the vertical bearing points to resist design overturning, uplift, and sliding forces. When engineered connectors are not installed, roof framing members shall be secured at the vertical bearing points to wall framing members (studs), and wall framing members (studs) shall be secured to floor framing members with 0.016 in. (0.4 mm) base metal minimum steel strapping or engineered connectors, or by a combination of 0.016 in. (0.4 mm) base metal minimum steel strapping or engineered connectors and structural-rated wall sheathing that overlaps the roof and floor system. Steel strapping or engineered connectors shall be installed at a maximum spacing of 24 in. (610 mm) on center in Wind Zones III and IV.

Exception: Where substantiated by structural analysis, the 0.016 in. (0.4 mm) base metal minimum steel strapping or engineered connectors shall be permitted to be omitted when the structural rated sheathing that overlaps either the roof or floor system is capable of sustaining the applied loads.

6.5.6 Walls. The walls shall be of sufficient strength to withstand the load requirements as defined in 6.5.3 for this part, without exceeding the deflections as specified in 6.5.4. The connections between the bearing walls, floor, and roof framework members shall be fabricated in such a manner as to provide support for the

material used to enclose the manufactured home and to provide for transfer of all lateral and vertical loads to the floor and chassis.

6.5.6.1 Studs shall not be notched or drilled in the middle one-third of their length.

Exception: Where substantiated by engineering analysis or tests.

6.5.6.2 Interior walls and partitions shall be constructed with structural capacity adequate for the intended purpose and shall be capable of resisting a horizontal load of not less than 5 lb/ft² (24 kg/m²). An allowable stress increase of 1.33 times the permitted published design values shall be permitted to be used in the design of wood-framed interior partitions. Finish of walls and partitions shall be securely fastened to wall framing.

6.5.7 Floors.

6.5.7.1 Floor assemblies, including stairways, landings, decks, and porches provided by the manufacturer, shall be designed in accordance with accepted engineering practice standards to support a minimum uniform live load of 40 lb/ft² (1.92 kN/m²) plus the dead load of the materials. Exterior balconies shall be designed to support a minimum uniform live load of 60 lb/ft² (2.88 kN/m²), plus the dead load of the materials. In addition (but not simultaneously), floors shall be able to support a 200 lb (90.7 kg) concentrated load on a 1 in. (25 mm) diameter disc at the most critical location, with a maximum deflection not to exceed ⅛ in. (3 mm) relative to floor framing. Perimeter wood joists of more than 6 in. (152 mm) depth shall be stabilized against overturning from superimposed loads in accordance with the following:

- (1) At ends, by solid blocking not less than 2 in. (50 mm) in thickness by full depth of joist or by connecting to a continuous header not less than 2 in. (50 mm) in thickness and not less than the depth of the joist with connecting devices
- (2) At 8 ft (2.4 m) maximum intermediate spacing, by solid blocking or by wood cross-bridging of not less than 1 in. × 3 in. (25 mm × 76 mm), metal cross-bridging of equal strength, or other approved methods

6.5.7.2 Wood, wood fiber, or wood-structural panel floors or subfloors in kitchens, bathrooms (including toilet compartments), laundry rooms, water heater compartments, and any other areas subject to excessive moisture shall be moisture resistant or shall be made moisture resistant by sealing or by an overlay of nonabsorbent material applied with water-resistant adhesive.

6.5.7.2.1 Application of any of the following methods shall be considered to be in accordance with this requirement:

- (1) Sealing the floor with a water-resistant sealer.
- (2) Installing an overlay of a nonabsorbent floor-covering material applied with water-resistant adhesive.
- (3) Direct application of a water-resistant sealer to the exposed wood floor area when covered with a nonabsorbent overlay.
- (4) The use of a nonabsorbent floor covering, which shall be permitted to be installed without a continuous application of a water-resistant adhesive or sealant when the floor covering meets the following criteria:
 - (a) The covering is a continuous membrane with any seams or patches seam-bonded or welded to preserve the continuity of the floor covering.

- (b) The floor is protected at all penetrations in these areas by sealing with a compatible water-resistant adhesive or sealant to prevent moisture from migrating under the nonabsorbent floor covering.
- (c) The covering is fastened around the perimeter of the subfloor in accordance with the floor-covering manufacturer's instructions.
- (d) The covering is designed to be installed to prevent moisture penetration without the use of a water-resistant adhesive or sealer, except as required in 6.5.7.
- i. The vertical edges of penetrations for plumbing shall be covered with a moisture-resistant adhesive or sealant.
 - ii. The vertical penetrations located under the bottom plates of perimeter walls of rooms, areas, or compartments shall not be required to be sealed; these vertical penetrations shall not include walls or partitions within the rooms or areas.

6.5.7.3 Wood panel products used as floor or subfloor materials on the exterior of the home, such as in recessed entry ways, shall be rated for exterior exposure and shall be protected from moisture by sealing or applying nonabsorbent overlay with water-resistant adhesive.

6.5.7.4 Carpet or carpet pads shall not be installed under concealed spaces subject to excessive moisture, such as plumbing fixture spaces or floor areas under installed laundry equipment. Carpet shall be permitted to be installed in laundry spaces, provided the following apply:

- (1) The appliances are not provided.
- (2) The conditions of 6.5.7.2 are followed.
- (3) Instructions are provided to remove carpet when appliances are installed.

6.5.7.5 Except where substantiated by engineering analysis or tests, the following requirements shall apply:

- (1) Notches on the ends of joists shall not exceed one-fourth the joist depth.
- (2) Holes bored in joists shall not be within 2 in. (51 mm) of the top or bottom of the joist, and the diameter of any such hole shall not exceed one-third the depth of the joist.
- (3) Notches in the top or bottom of the joists shall not exceed one-sixth the depth and shall not be located in the middle third of the span.

6.5.7.6 Bottom board material (with or without patches) shall meet or exceed the level of 48 in./lb (1219 mm/0.45 kg) of puncture resistance as tested by the Beach Puncture Test in accordance with ASTM D 781, *Standard Test Methods for Puncture and Stiffness of Paperboard, and Corrugated and Solid Fiberboard*.

6.5.7.6.1 The material shall be suitable for patches, and the patch life shall be equivalent to the material life. Patch installation instructions shall be included in the manufactured home manufacturer's instructions.

6.5.7.6.2 The bottom board material shall be tight fitted against all penetrations.

6.5.8 Roofs.

6.5.8.1 Roofs shall be of sufficient strength to withstand the load requirements as defined in 6.5.2 and 6.5.3, without exceeding the deflections specified in 6.5.4. The connections between roof framework members and bearing walls shall be fabricated to

provide for the transfer of design vertical and horizontal loads to the bearing walls and resistance to uplift forces.

6.5.8.2 Roofing membranes shall be of sufficient rigidity to prevent deflection that could lead to ponding of water or separation of seams due to wind, snow, ice, erection, or transportation forces.

6.5.8.3 Cutting of roof framework members for passage of electrical, plumbing, or mechanical systems shall not be permitted except where substantiated by engineering analysis.

6.5.8.4 All roof penetrations for electrical, plumbing, or mechanical systems shall be properly flashed and sealed. In addition, where a metal roof membrane is penetrated, a wood backer shall be installed. The backer plate shall be not less than $\frac{3}{16}$ in. (8 mm) plywood, with exterior glues, secured to the roof framing system beneath the metal roof, and shall be of a size to ensure that all screws securing the flashing are held by the backer plate.

6.5.8.5 The entire roof assembly, or portions thereof, including, but not limited to, dormers, gables, crickets, hinged roof sections, connections between sections, sheathing, roof coverings, underlayments, flashings, and eaves and overhangs shall be permitted to be assembled and installed on site provided that the requirements in 6.5.8.5.1 through 6.5.8.5.5 are met.

6.5.8.5.1 Approved installation instructions shall be provided that include requirements for the following items:

- (1) Materials, installation, and structural connections complying with Section 6.5
- (2) Installation and fastening of sheathing and roof coverings
- (3) Installation of appliance vent systems per Section 10.9
- (4) Installation of plumbing vents as required by Section 10.9
- (5) Installation of attic ventilation per 8.4.4

6.5.8.5.2 The installation instructions specified in 6.5.8.5.1 shall include drawings, details, and instructions as necessary to ensure that the on-site work complies with the approved design.

6.5.8.5.3 The installation instructions specified in 6.5.8.5.1 shall provide for on-site inspection of the work in stages that shall assure inspection before any work is concealed.

6.5.8.5.4 Listed trusses shall be provided as required by the approved design and installation instructions.

6.5.8.5.5 Temporary weather protection shall be provided per 6.7.5.

6.5.9 Frame Construction. The frame shall be capable of transmitting all design loads to stabilizing devices without exceeding the allowable load and deflections of this section. The frame also shall be capable of withstanding the effects of transportation shock and vibration without degradation, as required by Chapter 12.

6.5.9.1 Welded Connections.

6.5.9.1.1 All welds shall be made in accordance with the applicable provisions of AISC-S335, *Specification for Structural Steel Buildings, Allowable Stress Design and Plastic Design*; AISI-SG 971, *Specification for the Design of Cold-Formed Steel Structural Members*; and ASCE 8, *Design of Cold-Formed Stainless Steel Structural Members*.

6.5.9.1.2 Regardless of the provisions of any reference standard contained in this chapter, deposits of weld slag or flux shall be required to be removed only from welded joints at the following locations:

- (1) Drawbar and coupling mechanisms
- (2) Main member splices
- (3) Spring hanger to main member connections

6.5.9.2 Protection of Metal Frames Against Corrosion. Metal frames shall be made corrosion resistant or be protected against corrosion. Metal frames shall be permitted to be protected against corrosion by painting.

6.6 Windstorm Protection.

6.6.1 Provisions for Support and Anchoring Systems. Each manufactured home shall have provisions for support and anchoring or foundation systems that, when properly designed and installed, will resist overturning and lateral movement (sliding) of the manufactured home, as imposed by the respective design loads. The resistance shall be determined by the simultaneous application of the horizontal drag and uplift wind loads, in accordance with 6.5.3.1. The basic allowable stresses of materials required to resist overturning and lateral movement shall not be increased in the design and proportioning of these members. No additional shape or location factors shall be needed to be applied in the design of the tie-down system. No more than 60 percent of the dead load of the structure shall be permitted to be used to resist these wind loading effects in all wind zones.

6.6.1.1 The provisions of Section 6.6 shall be followed, and the support and anchoring systems shall be designed by a registered professional engineer or architect.

6.6.1.2 The manufacturer of each manufactured home shall be required to make provisions for the support and anchoring systems, but shall not be required to provide the anchoring equipment or stabilizing devices. When the manufacturer's installation instructions provide for the main frame structure to be used as the points for connection of diagonal ties, no specific connecting devices shall need to be provided on the main frame structure.

6.6.2 Contents of Instructions.

6.6.2.1 The manufacturer shall provide printed instructions with each manufactured home that specify the location and required capacity of stabilizing devices on which the design is based. In addition to the printed instructions, each column support pier location required along the marriage line(s) of multisection manufactured homes shall be identified by paint, label, decal, stencil, or other acceptable method at each pier location. Such location identifications shall be visible after the home is installed. The manufacturer shall provide drawings and specifications, certified by a registered professional engineer or architect, that indicate at least one acceptable system of anchoring, including the details or required straps or cables, their end connections, and all other devices needed to transfer the wind loads from the manufactured home to an anchoring or foundation system.

6.6.2.2 For anchoring systems, the instructions shall indicate the following:

- (1) Minimum anchor capacity shall be required.
- (2) Anchors shall be certified by a professional engineer, architect, or a nationally recognized testing laboratory as to their resistance, based on the maximum angle of diagonal tie and/or vertical tie loading (*see 6.6.3*) and angle of anchor installation, and type of soil in which the anchor is to be installed.

- (3) Ground anchors shall be embedded below the frost line and be at least 12 in. (305 mm) above the water table.
- (4) Ground anchors shall be installed to their full depth, and stabilizer plates shall be installed to provide added resistance to overturning or sliding forces.
- (5) Anchoring equipment shall be certified by a registered professional engineer or architect to resist these specified forces in accordance with testing procedures in ASTM D 3953, *Standard Specification for Strapping, Flat Steel, and Seals*.

6.6.3 Design Criteria. The provisions made for anchoring systems shall be based on the following design criteria for manufactured homes:

- (1) The minimum number of ties provided per side of each home shall resist design wind loads required in 6.5.3.1.
- (2) Ties shall be as evenly spaced as practicable along the length of the manufactured home, with not more than 2 ft (610 mm) open-end spacing on each end.
- (3) Vertical ties or straps shall be positioned at studs. Where a vertical tie and a diagonal tie are located at the same place, both ties shall be permitted to be connected to a single anchor, provided that the anchor used is capable of carrying both loadings simultaneously.
- (4) Add-on sections of expandable manufactured homes shall have provisions for vertical ties at the exposed ends.

6.6.4 Requirements for Ties. Manufactured homes in Wind Zone I shall require only diagonal ties. These ties shall be placed along the main frame and below the outer side walls. All manufactured homes designed to be located in Wind Zones II, III, and IV shall have both vertical and diagonal ties below the outer side walls.

6.6.5 Protection Requirements. Protection shall be provided at sharp corners where the anchoring system requires the use of external straps or cables. Protection also shall be provided to minimize damage to siding by the cable or strap.

6.6.6 Anchoring Equipment — Load Resistance. Anchoring equipment shall be capable of resisting an allowable working load equal to or exceeding 3150 lb (1430 kg) and withstanding a 50 percent overload for a total of 4725 lb (2140 kg) without failure of either the anchoring equipment or the attachment point on the manufactured home.

6.6.7 Anchoring Equipment — Weatherization. Anchoring equipment exposed to weathering shall have a resistance to weather deterioration at least equivalent to that provided by a coating of zinc on steel of not less than 0.30 oz/ft² (9 g/m²) of surface coated, and in accordance with the following:

- (1) Slit or cut edges of zinc-coated steel strapping shall not need to be zinc-coated.
- (2) Type 1, Finish B, Grade 1 steel strapping, 1¼ in. (32 mm) wide and 0.04 in. (1 mm) in thickness, certified by a registered professional engineer or architect as conforming with ASTM D 3953, *Standard Specification for Strapping, Flat Steel, and Seals*.

6.7 Resistance to Elements and Use.

6.7.1 Exterior coverings shall be of moisture- and weather-resistant materials attached with corrosion-resistant fasteners to resist wind, snow, and rain. Metal coverings and exposed metal structural members shall be of corrosion-resistant materials or shall be protected to resist corrosion. All joints between portions of the exterior covering shall be designed and