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CHAPTER XX—OFFICE OF ASSISTANT SECRETARY FOR HOUSING—FEDERAL HOUSING COMMISSIONER, DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

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AUTHORITY: 42 U.S.C. 3535(d), 5403, and 5424.

SOURCE: 40 FR 58752, Dec. 18, 1975, unless otherwise noted. Redesignated at 44 FR 20679, Apr. 6, 1979.

Subpart A—General

§ 3280.1 Scope.

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

[58 FR 55002, Oct. 25, 1993]

§ 3280.2 Definitions.

Definitions in this subpart are those common to all subparts of the standard and are in addition to the definitions provided in individual parts. The definitions are as follows:

Approved, when used in connection with any material, appliance or construction, means complying with the requirements of the Department of Housing and Urban Development.

Bay window—a window assembly whose maximum horizontal projection is not more than two feet from the plane of an exterior wall and is elevated above the floor level of the home.

Certification label means the approved form of certification by the manufacturer that, under § 3280.8, is permanently affixed to each transportable section of each manufactured home manufactured for sale in the United States.

Dwelling unit means one or more habitable rooms which are designed to be occupied by one family with facilities for living, sleeping, cooking and eating.

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

Federal manufactured home construction and safety standard means a reasonable standard for the construction, design, and performance of a manufactured home which meets the needs of the public including the need for quality, durability, and safety.

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

Labeled means a label, symbol or other identifying mark of a nationally recognized testing laboratory, inspection agency, or other organization concerned with product evaluation that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling is indicated compliance with nationally recognized standards or tests to determine suitable usage in a specified manner.

Length of a manufactured home means its 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.

Listed or certified means included in a list published by a nationally recognized testing laboratory, inspection agency, or other organization concerned with product evaluation that maintains periodic inspection of production of listed equipment or materials, and whose listing states either that the equipment or material meets nationally recognized standards or has been tested and found suitable for use in a specified manner.

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

Manufactured home means a structure, transportable in one or more sections, which in the traveling mode is 8 body feet or more in width or 40 body feet or more in length or which when erected on-site is 320 or more square feet, 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 the plumbing, heating, air-conditioning, and electrical systems contained in the structure. This term includes all structures that meet the above requirements except the size requirements and with respect to which the manufacturer voluntarily files a certification pursuant to § 3282.13 of this chapter and complies with the construction and safety standards set forth in this part 3280. The term does not include any self-propelled recreational vehicle. Calculations used to determine the number of square feet in a structure will include the total of square feet for each transportable section comprising the completed structure and will be based on the structure's exterior dimensions measured at the largest horizontal projections when erected on site. These dimensions will include all expandable rooms, cabinets, and other projections containing interior space, but do not include bay windows. Nothing in this definition should be interpreted to mean that a manufactured home necessarily meets the requirements of HUD's Minimum Property Standards (HUD Handbook 4900.1) or that it is automatically eligible for financing under 12 U.S.C. 1709(b).

Manufactured home construction means all activities relating to the assembly and manufacture of a manufactured home including, but not limited to, those relating to durability, quality and safety.

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

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

Secretary means the Secretary of Housing and Urban Development, or an official of the Department delegated the authority of the Secretary with respect to title VI of Pub. L. 93–383.

State includes each of the several States, the District of Columbia, the Commonwealth of Puerto Rico, Guam, the Virgin Islands, the Canal Zone, and American Samoa.

Width of a manufactured home means its largest overall width in the traveling mode, including cabinets and other projections which contain interior space. Width does not include bay windows, roof projections, overhangs, or eaves under which there is no interior space.

[40 FR 58752, Dec. 18, 1975, as amended at 42 FR 960, Jan. 4, 1977. Redesignated at 44 FR 20679, Apr. 6, 1979, as amended at 47 FR 28092, June 29, 1982; 58 FR 55002, Oct. 25, 1993; 61 FR 5216, Feb. 9, 1996; 72 FR 27228, May 14, 2007]

§ 3280.3 Manufactured home procedural and enforcement regulations and consumer manual requirements.

A manufacturer must comply with the requirements of this part 3280, part 3282 of this chapter, and 42 U.S.C. 5416.

[61 FR 18250, Apr. 25, 1996]

§ 3280.4 Incorporation by reference.

(a) The specifications, standards and codes of the following organizations are incorporated by reference in 24 CFR part 3280 (this Standard) pursuant to 5 U.S.C. 552(a) and 1 CFR part 51 as though set forth in full. The incorporation by reference of these standards has been approved by the Director of the Federal Register. Reference standards have the same force and effect as this Standard (24 CFR part 3280) except that whenever reference standards and this Standard are inconsistent, the requirements of this Standard prevail to the extent of the inconsistency.

(b) The abbreviations and addresses of organizations issuing the referenced standards appear below. Reference standards which are not available from their producer organizations may be obtained from the Office of Manufactured Housing and Regulatory Functions, Manufactured Housing and Construction Standards Division, U.S. Department of Housing and Urban Development, 451 Seventh Street, SW., room B–133, Washington, DC 20410.

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

AAMA—American Architectural Manufacturers Association, 1540 East Dundee Road, Palatine, Illinois 60067

AFPA [previously (N)FPA]—American Forest and Paper Association, 1250 Connecticut Avenue, NW., Washington, DC 20036 [previously named (N)FPA-National Forest Products Association]

AGA—American Gas Association, 8501 East Pleasant Valley Road, Cleveland, Ohio 44131

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

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

AITC—American Institute of Timber Construction, 11818 SE Mill Plain Blvd., suite 415, Vancouver, Washington 98684

ANSI—American National Standards Institute, 1430 Broadway, New York, New York 10018

APA—American Plywood Association, P.O. Box 11700, Tacoma, Washington 98411

ARI—Air Conditioning and Refrigeration Institute, 1501 Wilson Blvd., 6th Floor, Arlington, VA 22209–2403

ASCE—American Society of Civil Engineers, 345 East 47th Street, New York, New York 10017–2398

ASHRAE—American Society of Heating, Refrigeration and Air Conditioning Engineers, 1791 Tulle Circle, NE., Atlanta, Georgia 30329

ASME—American Society of Mechanical Engineers, 345 East 47th Street, New York, New York 10017

ASSE—American Society of Sanitary Engineering, P.O. Box 40362, Bay Village, Ohio 44140

ASTM—American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103

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

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, 7th and D Streets, SW., Washington, DC 20407

HPVA (previously HPMA)—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, 11491 Sunset Hills Road, Reston, VA 20190–5254

IAPMO—International Association of Plumbing and Mechanical Officials, 20001 Walnut Drive South, Walnut, CA 91784–2825

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, Pennsylvania 19120

NEMA—National Electrical Manufacturers Association, 1300 North 17th Street, Suite 1847, Rosslyn, VA 22209

NER—International Code Council Evaluation Service [Previously known as National Evaluation Service], 5360 Workman Mill Road, Whittier, CA 90601–0543

NFPA—National Fire Protection Association, Batterymarch Park, Quincy, MA 02269

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

NFRC—National Fenestration Rating Council, 8984 Georgia Avenue, Suite 320, Silver Spring, MD 20910

NSF—National Sanitation Foundation, P.O. Box 1468, Ann Arbor, MI 48105
NWWDA—National Wood Window and Door Association, 1400 E. Toughy Avenue, suite G–54, Des Plaines, IL 60018
SAE—Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, Pennsylvania 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, Wisconsin 53719
UL—Underwriters' Laboratories, Inc., 333 Pfingsten Road, Northbrook, Illinois 60062
WDMA—Window and Door Manufacturers Association [Previously known as the National Wood Window and Door Association, NWWDA], 1400 East Touhy Avenue, Des Plaines, IL 60018

(c) The Department will enforce the listed editions of material incorporated by reference into this standard. If a later edition is to be enforced, the Department will publish a notice of change in the FEDERAL REGISTER.

[47 FR 49385, Nov. 1, 1982, as amended at 52 FR 47553, Dec. 15, 1987; 58 FR 55002, Oct. 25, 1993; 59 FR 15113, Mar. 31, 1994; 70 FR 72042, Nov. 30, 2005]

§ 3280.5 Data plate.

Each manufactured home shall bear a data plate affixed in a permanent manner near the main electrical panel or other readily accessible and visible location. Each data plate shall be made of material what will receive typed information as well as preprinted information, and which can be cleaned of ordinary smudges or household dirt without removing information contained on the data plate; or the data plate 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. Each data plate shall contain not less than the following information:

(a) The name and address of the manufacturing plant in which the manufactured home was manufactured.

(b) The serial number and model designation of the unit, and the date the unit was manufactured.

(c) The statement:

This manufactured home is designed to comply with the Federal Manufactured Home Construction and Safety Standards in force at the time of manufacture.

(d) A list of the certification label(s) number(s) that are affixed to each transportable manufactured section under § 3280.8.

(e) A list of major factory-installed equipment, including the manufacturer's name and the model designation of each appliance.

(f) Reference to the roof load zone and wind load zone for which the home is designed and duplicates of the maps as set forth in § 3280.305(c). This information may be combined with the heating/cooling certificate and insulation zone map required by §§ 3280.510 and 3280.511. The Wind Zone Map on the Data Plate shall also contain the statement:

This home has not been designed for the higher wind pressures and anchoring provisions required for ocean/coastal areas and should not be located within 1500′ of the coastline in Wind Zones II and III, unless the home and its anchoring and foundation system have been designed for the increased requirements specified for Exposure D in ANSI/ASCE 7–88.

(g) 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 and III, 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 manufacturers printed instructions.

(h) The statement: ''Design Approval by'', followed by the name of the agency that approved the design.

[59 FR 2469, Jan. 14, 1994]

§ 3280.6 Serial number.

(a) A manufactured home serial number which will identify the manufacturer and the state in which the manufactured home is manufactured, must be stamped into the foremost cross member. Letters and numbers must be ⅜ inch minimum in height. Numbers must not be stamped into hitch assembly or drawbar.

§ 3280.7 Excluded structures.

Certain structures may be excluded from these Standards as modular homes under 24 CFR 3282.12.

[52 FR 4581, Feb. 12, 1987]

§ 3280.8 Waivers.

(a) Where any material piece of equipment, or system which does not meet precise requirements or specifications set out in the standard is shown, to the satisfaction of the Secretary, to meet an equivalent level of performance, the Secretary may waive the specifications set out in the Standard for that material, piece of equipment, or system.

(b) Where the Secretary is considering issuing a waiver to a Standard, the proposed waiver shall be published in the FEDERAL REGISTER for public comment, unless the Secretary, for good cause, finds that notice is impractical, unnecessary or contrary to the public interest, and incorporates into the waiver that finding and a brief statement of the reasons therefor.

(c) Each proposed and final waiver shall include:

(1) A statement of the nature of the waiver; and

(2) Identification of the particular standard affected.

(d) All waivers shall be published in the FEDERAL REGISTER and shall state their effective date. Where a waiver has been issued, the requirements of the Federal Standard to which the waiver relates may be met either by meeting the specifications set out in the Standard or by meeting the requirements of the waiver published in the FEDERAL REGISTER.

[58 FR 55003, Oct. 25, 1993]

§ 3280.9 Interpretative bulletins.

Interpretative bulletins may be issued for the following purposes:

(a) To clarify the meaning of the Standard; and

(b) To assist in the enforcement of the Standard.

[58 FR 55003, Oct. 25, 1993]

§ 3280.10 Use of alternative construction.

Requests for alternative construction can be made pursuant to 24 CFR 3282.14 of this chapter.

[58 FR 55003, Oct. 25, 1993]

§ 3280.11 Certification label.

(a) A permanent label shall be affixed to each transportable section of each manufactured home for sale or lease in the United States. This label shall be separate and distinct from the data plate which the manufacturer is required to provide under § 3280.5 of the standards.

(b) The label shall be approximately 2 in. by 4 in. in size and shall be permanently attached to the manufactured home by means of 4 blind rivets, drive screws, or other means that render it difficult to remove without defacing it. It shall be etched on 0.32 in. thick aluminum plate. The label number shall be etched or stamped with a 3 letter designation which identifies the production inspection primary inspection agency and which the Secretary shall assign. Each label shall be marked with a 6 digit number which the label supplier shall furnish. The labels shall be stamped with numbers sequentially.

(c) The label shall read as follows:

As evidenced by this label No. ABC 000001, the manufacturer certifies to the best of the manufacturer's knowledge and belief that this manufactured home has been inspected in accordance with the requirements of the Department of Housing and Urban Development and is constructed in conformance with the Federal manufactured home construction and safety standards in effect on the date of manufacture. See date plate.

(d) The label shall be located at the tail-light end of each transportable section of the manufactured home approximately one foot up from the floor and one foot in from the road side, or as near that location on a permanent part of the exterior of the manufactured home unit as practicable. The road side is the right side of the manufactured home when one views the

manufactured home from the tow bar end of the manufactured home.

[42 FR 960, Jan. 4, 1977. Redesignated at 44 FR 20679, Apr. 6, 1979, as amended at 52 FR 47553, Dec. 15, 1987. Redesignated and amended at 58 FR 55003, Oct. 25, 1993]

Subpart B—Planning Considerations

§ 3280.101 Scope.

Subpart B states the planning requirements in manufactured homes. The intent of this subpart is to assure the adequacy of architectural planning considerations which assist in determining a safe and healthful environment.

§ 3280.102 Definitions.

(a) *Gross floor area* means all space, wall to wall, including recessed entries not to exceed 5 sq. ft. and areas under built-in vanities and similar furniture. Where the ceiling height is less than that specified in § 3280.104, the floor area under such ceilings shall not be included. Floor area of closets shall not be included in the gross floor area.

(b) *Habitable room* means 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.

(c) *Laundry area* means an area containing or designed to contain a laundry tray, clothes washer and/or clothes dryer.

§ 3280.103 Light and ventilation.

(a) *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.

(1) Kitchens, bathrooms, toilet compartments, laundry areas, and utility rooms may be provided with artificial light in place of windows.

(2) Rooms and areas may 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 square feet whichever is greater.

(b) *Whole-house ventilation*. Each manufactured home must be provided with whole-house ventilation having a minimum capacity of 0.035 $ft^3/min/ft^2$ of interior floor space or its hourly average equivalent. This ventilation capacity must be in addition to any openable window area. In no case shall the installed ventilation capacity of the system be less than 50 cfm nor more than 90 cfm. The following criteria must be adhered to:

(1) The ventilation capacity must be provided by a mechanical system or a combination passive and mechanical system. The ventilation system or provisions for ventilation must not create a positive pressure in Uo Value Zone 2 and Zone 3 or a negative pressure condition in Uo Value Zone 1. Mechanical systems must be balanced. Combination passive and mechanical systems must have adequately sized inlets or exhaust to release any unbalanced pressure. Temporary pressure imbalances due to gusting or high winds are permitted.

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

(3) The ventilation system or a portion of the system is permitted to be integral with the home's heating or cooling system. The system must be capable of operating independently of the heating or cooling modes. A ventilation system that is integral with the heating or cooling system is to be listed as part of the heating and cooling system or listed as suitable for use with that system.

(4) A mechanical ventilation system, or mechanical portion thereof, must be

provided with a manual control, and must be permitted to be provided with automatic timers or humidistats.

(5) A whole-house ventilation label must be attached to the whole-house ventilation control, must be permanent, and must state: ''WHOLE-HOUSE VENTILATION''.

(6) Instructions for correctly operating and maintaining whole-house ventilation systems must be included with the homeowner's manual. The instructions must encourage occupants to operate these systems whenever the home is occupied, and must refer to the labeled whole-house ventilation control.

(c) *Additional ventilation.* (1) At least half of the minimum required glazed area in paragraph (a) of this section shall be openable directly to the outside of the manufactured home for unobstructed ventilation. These same ventilation requirements apply to rooms combined in accordance with § 3280.103(a)(2).

(2) Kitchens shall be provided with a mechanical ventilation system that is capable of exhausting 100 cfm to the outside of the home. The exhaust fan shall be located as close as possible to the range or cook top, but in no case farther than 10 feet horizontally from the range or cook top.

(3) Each bathroom and separate toilet compartment shall be provided with a mechanical ventilation system capable of exhausting 50 cfm to the outside of the home. A separate toilet compartment may be provided with 1.5 square feet of openable glazed area in place of mechanical ventilation, except in Uo value Zone 3.

[58 FR 55003, Oct. 25, 1993, as amended at 70 FR 72042, Nov. 30, 2005]

§ 3280.104 Ceiling heights.

(a) Every habitable room and bathroom shall have a minimum ceiling height of not less than 7 feet, 0 inches for a minimum of 50 percent of the room's floor area. The remaining area may have a ceiling with a minimum height of 5 feet, 0 inches. Minimum height under dropped ducts, beams, etc. shall be 6 feet, 4 inches.

(b) Hallways and foyers shall have a minimum ceiling height of 6 feet, 6 inches.

§ 3280.105 Exit facilities; exterior doors.

(a) *Number and location of exterior doors.* Manufactured homes shall have a minimum of two exterior doors located remote from each other.

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

(2) In order for exit doors to be considered *remote* from each other, they must comply with all of the following:

(i) Both of the required doors must not be in the same room or in a group of rooms which are not defined by fixed walls.

(ii) *Single wide units.* Doors may not be less than 12 ft. c-c from each other as measured in any straight line direction regardless of the length of path of travel between doors.

(iii) *Double wide units.* Doors may not be less than 20 ft. c-c from each other as measured in any straight line direction regardless of the length of path of travel between doors.

(iv) One of the required exit doors must be accessible from the doorway of each bedroom without traveling more than 35 ft.

(b) *Door design and construction.* (1) Exterior swinging doors shall be constructed in accordance with § 3280.405 the ''Standard for Swinging Exterior Passage Doors for Use in Manufactured Homes''. Exterior sliding glass doors shall be constructed in accordance with § 3280.403 the ''Standard for Windows and Sliding Glass Doors Used in Manufactured Homes''.

(2) All exterior swinging doors shall provide a minimum 28 inch wide by 74 inch high clear opening. All exterior sliding glass doors shall provide a minimum 28 inch wide by 72 inch high clear opening.

(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) All exterior doors, including storm and screen doors, opening outward shall be provided with a safety door check.

[40 FR 58752, Dec. 18, 1975. Redesignated at 44 FR 20679, Apr. 6, 1979, as amended at 50 FR 9269, Mar. 7, 1985]

§ 3280.106 Exit facilities; egress windows and devices.

(a) Every room designed expressly for sleeping purposes, unless it has an exit door (*see* § 3280.105), shall have at least one outside window or approved exit device which meets the requirements of § 3280.404, the ''Standard for Egress Windows and Devices for Use in Manufactured Homes.''

(b) The bottom of the window opening shall not be more than 36 inches above the floor.

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

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

[49 FR 58752, Dec. 18, 1975. Redesignated at 44 FR 20679, Apr. 6, 1979, as amended at 49 FR 36086, Sept. 14, 1984; 52 FR 4581, Feb. 12, 1987]

§ 3280.107 Interior privacy.

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

§ 3280.108 Interior passage.

(a) 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 of the hardware mechanism in any direction.

(b) Each manufactured home interior door, when provided with a privacy lock, shall have a privacy lock that has 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 on the inside.

§ 3280.109 Room requirements.

(a) Every manufactured home shall have at least one living area with not less than 150 sq. ft. of gross floor area.

(b) Rooms designed for sleeping purposes shall have a minimum gross square foot floor area as follows:

(1) All bedrooms shall have at least 50 sq. ft. of floor area.

(2) Bedrooms designed for two or more people shall have 70 sq. ft. of floor area plus 50 sq. ft. for each person in excess of two.

(c) Every room designed for sleeping purposes shall have accessible clothes hanging space with a minimum inside depth of 22 inches and shall be equipped with a rod and shelf.

[40 FR 58752, Dec. 18, 1975. Redesignated at 44 FR 20679, Apr. 6, 1979, and further redesignated at 58 FR 55004, Oct. 25, 1993]

§ 3280.110 Minimum room dimensions.

The gross floor area required by § 3280.110 (a) and (b) shall have no clear horizontal dimension less than 5 feet except as permitted by § 3280.102(a).

[40 FR 58752, Dec. 18, 1975. Redesignated at 44 FR 20679, Apr. 6, 1979, and further redesignated at 58 FR 55004, Oct. 25, 1993]

§ 3280.111 Toilet compartments.

Each toilet compartment shall be a minimum of 30 inches in width, except, when the toilet is located adjacent to the short dimension of the tub, the distance from the tub to the center line of the toilet shall not be less than 12 inches. At least 21 inches of clear space shall be provided in front of each toilet.

[40 FR 58752, Dec. 18, 1975. Redesignated at 44 FR 20679, Apr. 6, 1979, and further redesignated at 58 FR 55004, Oct. 25, 1993]

§ 3280.112 Hallways.

Hallways shall have a minimum horizontal dimension of 28 inches measured from the interior finished surface to the interior finished surface of the opposite wall. When appliances are installed in a laundry area, the measurement shall be from the front of the appliance to the opposite finished interior surface. When appliances are not installed and a laundry area is provided, the area shall have a minimum clear depth of 27 inches in addition to

the 28 inches 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 alarms or light fixtures are permitted.

[40 FR 58752, Dec. 18, 1975. Redesignated at 44 FR 20679, Apr. 6, 1979, and further redesignated at 58 FR 55004, Oct. 25, 1993; 67 FR 12817, Mar. 19, 2002]

§ 3280.113 Glass and glazed openings.

(a) *Windows and sliding glass doors.* All windows and sliding glass doors shall meet the requirements of § 3280.403 the ''Standard for Windows and Sliding Glass Doors Used in Manufactured Homes''.

(b) *Safety glazing.* Glazing in all entrance or exit doors, sliding glass doors, units (fixed or moving sections), unframed glass doors, unbacked mirrored wardrobe doors (*i.e.*, mirrors not secured to a backing capable of being the door itself), shower and bathtub enclosures and surrounds to a height of 6 feet above the bathroom floor level, storm doors or combination doors, and in panels located within 12 inches on either side of exit or entrance doors shall be of a safety glazing material. Safety glazing material is considered to be any glazing material capable of passing the requirements of Safety Performance Specifications and Methods of Test for Safety Glazing Materials Used in Buildings, ANSI Z97.1–1984.

[40 FR 58752, Dec. 18, 1975. Redesignated at 44 FR 20679, Apr. 6, 1979, as amended at 52 FR 4581, Feb. 12, 1987. Redesignated at 58 FR 55004, Oct. 25, 1993]

Subpart C—Fire Safety

SOURCE: 49 FR 32008, Aug. 9, 1984, unless otherwise noted.

§ 3280.201 Scope.

The purpose of this subpart is to set forth requirements that will assure reasonable fire safety to the occupants by reducing fire hazards and by providing measures for early detection.

§ 3280.202 Definitions.

The following definitions are applicable to subparts C, H, and I of the Standards:

Combustible material: Any material not meeting the definition of limited-combustible or non-combustible material.

Flame-spread rating: 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 subpart.

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 does not include:

(1) Trim and sealant 2 inches 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 § 3280.203(b)(3) or (4), and trim 6 inches 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 feet in width;

(4) Skylights and frames;

(5) Casings around doors, windows, and skylights not exceeding 4 inches in width;

(6) Furnishings which are not permanently affixed to the home's structure;

(7) Baseboards not exceeding 6 inches in height;

(8) Light fixtures, cover plates of electrical receptacle outlets, switches, and other devices;

(9) Decorative items attached to walls and partitions (i.e., pictures, decorative objects, etc.) constituting no more than 10% of the aggregate wall surface area in any room or space not more than 32 square feet in surface area, whichever is less;

(10) Plastic light diffusers when suspended from a material which meets the interior finish provisions of § 3280.203(b);

(11) Coverings and surfaces of exposed wood beams; and

(12) Decorative items including the following:

(i) Non-structural beams not exceeding 6 inches in depth and 6 inches in width and spaced not closer than 4 feet on center;

(ii) Non-structural lattice work;

(iii) Mating and closure molding; and

(iv) Other items not affixed to the home's structure.

Limited combustible: A material meeting:

(1) The definition contained in Chapter 2 of NFPA 220–1995, Standard on Types of Building Construction; or

(2) 5/16-inch or thicker gypsum board.

Noncombustible material: A material meeting the definition contained in Chapter 2 of NFPA 220–1995, Standard on Types of Building Construction.

Smoke alarm: An alarm device that is responsive to smoke.

Tactile notification appliance: A notification appliance that alerts by the sense of touch or vibration.

[58 FR 55004, Oct. 25, 1993, as amended at 67 FR 12817, Mar. 19, 2002; 70 FR 72042, Nov. 30, 2005]

§ 3280.203 Flame spread limitations and fire protection requirements.

(a) *Establishment of flame spread rating.* The surface flame spread rating of interior-finish material must not exceed the value shown in § 3280.203(b) when tested by Standard Test Method for Surface Burning Characteristics of Building Materials, ASTM E84–01, 2001, or Standard Method of Test of Surface Burning Characteristics of Building Materials NFPA 255, 1996, except that the surface flame spread rating of interior-finish materials required by § 3280.203(b)(5) and (6) may be determined by using the Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source, ASTM E 162–94. However, the following materials need not be tested to establish their flame spread rating unless a lower rating is required by the standards in this part:

(1) Flame-spread rating—76 to 200.

(i) .035-inch or thicker high pressure laminated plastic panel countertop;

(ii) 1/4-inch or thicker unfinished plywood with phenolic or urea glue;

(iii) Unfinished dimension lumber (1-inch or thicker nominal boards);

(iv) 3/8-inch or thicker unfinished particleboard with phenolic or urea binder;

(v) Natural gum-varnished or latex- or alkyd-painted:

(A) 1/4-inch or thicker plywood, or

(B) 3/8-inch or thicker particleboard, or

(C) 1-inch or thicker nominal board;

(vi) 5/16-inch gypsum board with decorative wallpaper; and

(vii) 1/4-inch or thicker unfinished hardboard,

(2) Flame-spread rating-25 to 200,

(i) Painted metal;

(ii) Mineral-base acoustic tile;

(iii) 5/16-inch or thicker unfinished gypsum wallboard (both latex- or alkyd-painted); and

(iv) Ceramic tile.

(The above-listed material applications do not waive the requirements of § 3280.203(c) or § 3280.204 of this subpart.)

(b) Flame-spread rating requirements.

(1) The interior finish of all walls, columns, and partitions shall not have a flame spread rating exceeding 200 except as otherwise specified herein.

(2) Ceiling interior finish shall not have a flame spread rating exceeding 75.

(3) Walls adjacent to or enclosing a furnace or water heater and ceilings above them shall have an interior finish with a flame spread rating not exceeding 25. Sealants and other trim materials 2 inches or less in width used to finish adjacent surfaces within these spaces are exempt from this provision provided that all joints are completely supported by framing members or by materials having a flame spread rating not exceeding 25.

(4) Exposed interior finishes adjacent to the cooking range shall have a flame spread rating not exceeding 50, except that backsplashes not exceeding 6 inches in height are exempted. Adjacent surfaces are the exposed vertical surfaces between the range top height and the overhead cabinets and/or ceiling and within 6 horizontal inches of the cooking range. (Refer also to § 3280.204(a), Kitchen Cabinet Protection.) Sealants and other trim materials 2 inches or less in width used to finish adjacent surfaces are exempt from this provision provided that all

joints are completely supported by a framing member.

(5) Kitchen cabinet doors, countertops, backsplashes, exposed bottoms, and end panels shall have a flame spread rating not to exceed 200. Cabinet rails, stiles, mullions, and top strips are exempted.

(6) Finish surfaces of plastic bathtubs, shower units, and tub or shower doors shall not exceed a flame spread rating of 200.

(c) Fire protective requirements.

(1) Materials used to surface the following areas shall be of limited combustible material (e.g., 5/16-inch gypsum board, etc.):

(i) The exposed wall adjacent to the cooking range (see § 3280.203(b)(4));

(ii) Exposed bottoms and sides of kitchen cabinets as required by § 3280.204;

(iii) Interior walls and ceilings enclosing furnace and/or water heater spaces; and

(iv) Combustible doors which provide interior or exterior access to furnace and/or water heater spaces. The surface may 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).

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

[49 FR 32008, Aug. 9, 1984, as amended at 58 FR 55005, Oct. 25, 1993; 70 FR 72042, Nov. 30, 2005]

§ 3280.204 Kitchen cabinet protection.

(a) The bottom and sides of combustible kitchen cabinets over cooking ranges to a horizontal distance of 6 inches from the outside edge of the cooking range shall be protected with at least 5/16-inch thick gypsum board or equivalent limited combustible material. One-inch nominal framing members and trim are exempted from this requirement. The cabinet area over the cooking range or cooktops shall be protected by a metal hood (26-gauge sheet metal, or .017 stainless steel, or .024 aluminum, or .020 copper) with not less than a 3-inch eyebrow projecting horizontally from the front cabinet face. The 5/16-inch thick gypsum board or equivalent material which is above the top of the hood may be supported by the hood. A 3/8-inch 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.

(b) The 3-inch metal eyebrow required by paragraph (a) of this section will project from the front and rear cabinet faces when there is no adjacent surface behind the range, or the 5/16-inch thick gypsum board or equivalent material shall be extended to cover all exposed rear surfaces of the cabinet.

(c) The metal hood required by paragraphs (a) and (b) of this section can be omitted when an oven of equivalent metal protection is installed between the cabinet and the range and all exposed cabinet surfaces are protected as described in paragraph (a) of this section.

(d) When a manufactured home is designed for the future installation of a cooking range, the metal hood and cabinet protection required by paragraph (a) of this section and the wall-surfacing protection behind the range required by § 3280.203 shall be installed in the factory.

(e) Vertical clearance above cooking top. Ranges shall have a vertical clearance above the cooking top of not less than 24 inches to the bottom of combustible cabinets.

§ 3280.205 Carpeting.

Carpeting shall not be used in a space or compartment designed to contain only a furnace and/or water heater. Carpeting may 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.

§ 3280.206 Fireblocking.

(a) *General.* Fireblocking must comply with the requirements of this section. The integrity of all fireblocking materials must be maintained.

(b) *Fireblocking materials.* Fireblocking must consist of the following materials:

(1) Minimum one inch nominal lumber, 5/16 inch thick gypsum board, or equivalent fire resistive materials; or

(2) Other Listed or Approved Materials;

(c) *Fireblocking locations.* (1) Fireblocking must be installed in concealed spaces of stud walls, partitions, and furred spaces at the floor and ceiling levels. Concealed spaces must not communicate between floor levels. Concealed spaces must not communicate between a ceiling level and a concealed roof area, or an attic space.

(2) Fireblocking must be installed at the interconnection of a concealed vertical space and a concealed horizontal space that occurs:

(i) Between a concealed wall cavity and the ceiling joists above; and

(ii) At soffits, drop ceilings, cover ceilings, and similar locations.

(3) Fireblocking must be installed around the openings for pipes, vents, and other penetrations in walls, floors, and ceilings of furnace and water heater spaces. Pipes, vents, and other penetrations that cannot be moved freely within their opening are considered to be fireblocked. Materials used to fireblock heat producing vent penetrations must be noncombustible or limited combustible types.

[71 FR 72042, Nov. 30, 2005]

§ 3280.207 Requirements for foam plastic thermal insulating materials.

(a) *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:

(1) The foam plastic insulating material is protected by an interior finish of 5/16-inch thick gypsum board or equivalent material for all cavities where the material is to be installed; or

(2) The foam plastic is used as a sheathing or siding backerboard, and it:

(i) Has a flame spread rating of 75 or less and a smoke-developed rating of 450 or less (not including outer covering of sheathing);

(ii) Does not exceed 3/8-inch in thickness; and

(iii) Is separated from the interior of the manufactured home by a minimum of 2 inches of mineral fiber insulation or an equivalent thermal barrier; or

(3) The foam plastic insulating material has been previously accepted by the Department for use in wall and/or ceiling cavities of manufactured homes, and it is installed in accordance with any restrictions imposed at the time of that acceptance; or

(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 (IIT) Report, ''Development of Mobile Home Fire Test Methods to Judge the Fire-Safe Performance of Foam Plastic Sheathing and Cavity Insulation, IITRI Fire and Safety Research Project J–6461, 1979'' or other full-scale fire tests accepted by HUD, and it is installed in a manner consistent with the way the material was installed in the foam plastic test module. The materials must be capable of meeting the following acceptance criteria required for their location:

(i) *Wall assemblies.* The foam plastic system shall demonstrate equivalent or superior performance to the control module as determined by:

(A) Time to reach flashover (600 °C in the upper part of the room);

(B) Time to reach an oxygen (O_2) level of 14% (rate of O_2 depletion), a carbon monoxide (CO) level of 1%, a carbon dioxide (CO_2) level of 6%, and a smoke level of 0.26 optical density/meter measured at 5 feet high in the doorway; and

(C) Rate of change concentration for O_2, CO, CO_2 and smoke measured 3 inches below the top of the doorway.

(ii) *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.

(iii) *Post-test damage assessment for wall and ceiling assemblies.* The overall performance of each total system shall also be evaluated in determining the acceptability of a particular foam plastic insulating material.

(b) All foam plastic thermal insulating materials used in manufactured

housing shall have a flame spread rating of 75 or less (not including outer covering or sheathing) and a maximum smoke-developed rating of 450.

[49 FR 32008, Aug. 9, 1984, as amended at 70 FR 72043, Nov. 30, 2005]

§ 3280.208 Smoke alarm requirements.

(a) *Labeling*. Each smoke alarm required under paragraph (b) of this section must conform with the requirements of UL 217, Single and Multiple Station Smoke Alarms, dated January 4, 1999 (incorporated by reference, see § 3280.4), or UL 268, Smoke Detectors for Fire Protective Signaling Systems, dated January 4, 1999 (incorporated by reference, see § 3280.4), and must bear a label to evidence conformance.

(b) *Required smoke alarm locations*. (1) At least one smoke alarm must be installed in each of the following locations:

(i) To protect both the living area and kitchen space. Manufacturers are encouraged to locate the alarm in the living area remote from the kitchen and cooking appliances. A smoke alarm located within 20 feet horizontally of a cooking appliance must incorporate a temporary silencing feature or be of a photoelectric type.

(ii) In each room designed for sleeping.

(iii) On the ceiling of the upper level near the top or above each stairway, other than a basement stairway, in any multistory home completed in accordance with this part or part 3282 of this chapter. The alarm must be located so that smoke rising in the stairway cannot be prevented from reaching the alarm by an intervening door or obstruction.

(2) For each home designed to be placed over a basement, the manufacturer must provide a smoke alarm for the basement and must install at the factory an electrical junction box for the installation of this smoke alarm and for its interconnection to other smoke alarms required by this section. The instructions for installers and information for homeowners required in paragraph (f) of this section must clearly indicate that a smoke alarm should be installed and is to be located on the basement ceiling near the stairway.

(3) A smoke alarm required under this section must not be placed in a location that impairs its effectiveness or in any of the following locations:

(i) Within 3 feet horizontally from any discharge grille when a home is equipped or designed for future installation of a roof-mounted evaporative cooler or other equipment discharging conditioned air through a ceiling grille into the living space; and

(ii) In any location or environment that is prohibited by the terms of its listing, except as permitted by this section.

(c) *Mounting requirements*. (1) Except in rooms with peaked sloping or shed sloping ceilings with a slope of more than 1.5/12 or as permitted pursuant to paragraph (e) of this section, smoke alarms must be mounted either:

(i) On the ceiling at least 4 inches from each wall; or

(ii) On a wall with the top of the alarm not less than 4 inches below the ceiling, and not farther from the ceiling than 12 inches or the distance from the ceiling specified in the smoke alarm manufacturer's listing and instructions, whichever is less.

(2) Except as permitted pursuant to paragraph (e) of this section, in rooms with peaked sloping ceilings with a slope of more than 1.5/12, smoke alarms must be mounted on the ceiling within 3 feet, measured horizontally, from the peak of the ceiling; at least 4 inches, measured vertically, below the peak of the ceiling; and at least 4 inches from any projecting structural element.

(3) Except as permitted pursuant to paragraph (e) of this section, in rooms with shed sloping ceilings with a slope of more than 1.5/12, smoke alarms must be mounted on the ceiling within 3 feet, measured horizontally, of the high side of the ceiling, and not closer than 4 inches from any adjoining wall surface and from any projecting structural element.

(d) *Connection to power source*. (1) Each smoke alarm must be powered from:

(i) The electrical system of the home as the primary power source and a battery as a secondary power source; or

(ii) A battery rated for a 10-year life, provided the smoke alarm is listed for use with a 10-year battery.

(2) Each smoke alarm whose primary power source is the home electrical system must be mounted on an electrical outlet box and connected by a permanent wiring method to a general electrical circuit. More than one smoke alarm is permitted to be placed on the same electrical circuit. The wiring circuit for the alarm must not include any switches between the overcurrent protective device and the alarm, and must not be protected by a ground fault circuit interrupter.

(3) Smoke alarms required under this section must be interconnected such that the activation of any one smoke alarm causes the alarm to be triggered in all required smoke alarms in the home.

(e) *Visible and tactile notification appliances.* (1) In addition to the smoke alarms required pursuant to this section, the manufacturer must provide visible and listed tactile notification appliances if these appliances are ordered by the purchaser or retailer before the home enters the first stage of production. These appliances are required to operate from the primary power source, but are not required to operate from a secondary power source.

(2) A visible notification appliance in a room designed for sleeping must have a minimum rating of 177 candela, except that when the visible notification appliance is wall-mounted or suspended more than 24 inches below the ceiling, a minimum rating of 110 candela is permitted.

(3) A visible notification appliance in an area other than a room designed for sleeping must have a minimum rating of 15 candela.

(f) *Testing and maintenance.* (1) Each required smoke alarm installed at the factory must be operationally tested, after conducting the dielectric test specified in § 3280.810(a), in accordance with the alarm manufacturer's instructions. A smoke alarm that does not function as designed during the test and is not fixed so that it functions properly in the next retest must be replaced. Any replacement smoke alarm must be successfully tested in accordance with this paragraph.

(2) Home manufacturers must provide specific written instructions for installers on how to inspect and test the operation of smoke alarms during installation of the home. These instructions must indicate that any smoke alarm that does not meet the inspection or testing requirements needs to be replaced and retested.

(3) Home manufacturers must provide the homeowner with the alarm manufacturer's information describing the operation, method and frequency of testing, and proper maintenance of the smoke alarm. This information must be provided in same manner and location as the consumer manual required by § 3282.207 of this chapter, but does not have to be incorporated into the consumer manual. No dealer, distributor, construction contractor, or other person shall interfere with the distribution of this information

[67 FR 12817, Mar. 19, 2002, as amended at 67 FR 49795, July 31, 2002]

§ 3280.209 Fire testing.

All fire testing conducted in accordance with this subpart shall be performed by nationally recognized testing laboratories which have expertise in fire technology. In case of dispute, the Secretary shall determine if a particular agency is qualified to perform such fire tests.

[49 FR 32011, Aug. 9, 1984]

Subpart D—Body and Frame Construction Requirements

§ 3280.301 Scope.

This subpart covers the minimum requirements for materials, products, equipment and workmanship needed to assure that the manufactured home will provide:

(a) Structural strength and rigidity,

(b) Protection against corrosion, decay, insects and other similar destructive forces,

(c) Protection against hazards of windstorm,

(d) Resistance to the elements, and

(e) Durability and economy of maintenance.

§ 3280.302 Definitions.

The following definitions are applicable to subpart D only:

Anchor assembly means any device or other means designed to transfer home anchoring loads to the ground.

Anchoring equipment means ties, straps, cables, turnbuckles, chains, and other approved components, including tensioning devices that are used to secure a manufactured home to anchor assemblies.

Anchoring system means a combination of anchoring equipment and anchor assemblies that will, when properly designed and installed, resist the uplift, overturning, and lateral forces on the manufactured home and on its support and foundation system.

Diagonal tie means a tie intended to resist horizontal or shear forces, but which may resist vertical, uplift, and overturning forces.

Footing: means that portion of the support system that transmits loads directly to the soil.

Foundation system means a system of support that is capable of transferring all design loads to the ground, including elements of the support system as defined in this section, or a site-built permanent foundation that meets the requirements of 24 CFR 3282.12.

Ground anchor means a specific anchoring assembly device designed to transfer home anchoring loads to the ground.

Loads: (1) *Dead load:* means the weight of all permanent construction including walls, floors, roof, partition, and fixed service equipment.

(2) *Live load:* means the weight superimposed by the use and occupancy of the manufactured home, including wind load and snow load, but not including dead load.

(3) *Wind load:* means the lateral or vertical pressure or uplift on the manufactured home due to wind blowing in any direction.

Main frame: means the structural component on which is mounted the body of the manufactured home.

Pier: means that portion of the support system between the footing and manufactured home exclusive of caps and shims.

Sheathing: means material which is applied on the exterior side of a building frame under the exterior weather resistant covering.

Stabilizing devices means all components of the anchoring and support systems, such as piers, footings, ties, anchoring equipment, anchoring assemblies, or any other equipment, materials, and methods of construction that support and secure the manufactured home to the ground.

Support system: means a combination of footings, piers, caps, and shims that will, when properly installed, support the manufactured home.

Support system means any pilings, columns, footings, piers, foundation walls, shims, and any combination thereof that, when properly installed, support the manufactured home.

Tie: means straps, cable, or securing devices used to connect the manufactured home to ground anchors.

Vertical tie: means a tie intended to resist the uplifting or overturning forces.

[58 FR 55005, Oct. 25, 1993; 59 FR 15113, Mar. 31, 1994, as amended at 72 FR 59361, Oct. 19, 2007]

§ 3280.303 General requirements.

(a) *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 may exceed these standards provided such deviation does not result in any inferior installation or defeat the purpose and intent of this standard.

(b) *Construction.* All construction methods shall be in conformance with accepted engineering practices to insure durable, livable, and safe housing and shall demonstrate acceptable workmanship reflecting journeyman quality of work of the various trades.

(c) *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 occur. (See subparts E and J.)

(d) [Reserved]

(e) *New materials and methods.* (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.

(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 paragraph (g) of this section.

(f) *Allowable design stress.* The design stresses of all materials shall conform to accepted engineering practice. The use of materials not certified as to strength or stress grade shall be limited to the minimum allowable stresses under accepted engineering practice.

(g) *Alternative test procedures.* In the absence of recognized testing procedures either in the Standards in this part or in the applicable provisions of those standards incorporated in this part by reference, the manufacturer electing this option must develop or cause to be developed testing procedures to demonstrate the structural properties and significant characteristics of the material, assembly, subassembly component, or member, except for testing methods involving one-piece metal roofing as would be required in § 3280.305(c)(1)(iii). Such testing procedures become part of the manufacturer's approved design. Such tests must be witnessed by an independent licensed professional engineer or architect or by a recognized testing organization. Copies of the test results must be kept on file by the manufactured home manufacturer.

[40 FR 58752, Dec. 18, 1975. Redesignated at 44 FR 20679, Apr. 6, 1979, as amended at 58 FR 55005, Oct. 25, 1993; 59 FR 2469, Jan. 14, 1994; 70 FR 72043, Nov. 30, 2005]

§ 3280.304 Materials.

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

(b)(1) Standards for some of the generally used materials and methods of construction are listed in the following table:

Aluminum

Aluminum Design Manual, Specifications and Guidelines for Aluminum Structures, Part 1-A, Sixth Edition, October 1994, and Part 1-B, First Edition, October 1994.

Steel

Specification for Structural Steel Buildings—Allowable Stress Design and Plastic Design—AISC–S335, 1989. The following parts of this reference standard are not 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.

Specification for the Design of Cold-Formed Steel Structural Members—AISI–1996.

Specification for the Design of Cold-Formed Stainless Steel Structural Members—SEI/ASCE 8–02, 2002.

Standard Specifications Load Tables and Weight Tables for Steel Joists and Joist Girders, SJI, Fortieth Edition, 1994.

Structural Applications of Steel Cables for Buildings—ASCE19, 1996.

Standard Specification for Strapping, Flat Steel and Seals—ASTM D3953, 1991.

Wood and Wood Products

Basic Hardboard—ANSI/AHA A135.4–1995.

Prefinished Hardboard Paneling—ANSI/AHA A135.5–1995.

Hardboard Siding—ANSI/AHA A135.6–1998.

American National Standard for Hardwood and Decorative Plywood—ANSI/HPVA HP–1–1994 (Approved 1995).

Structural Design Guide for Hardwood Plywood Wall Panels—HPVA Design Guide HP–SG–96, 1996.

For wood products—Structural Glued Laminated Timber—ANSI/AITC A190.1–1992.

Construction and Industrial Plywood (With Typical APA Trademarks)—PS 1–95.

APA Design/Construction Guide, Residential and Commercial—APA E30-P–1996.

Design Specifications for Metal Plate and Wood Connected Trusses—TPI–85.

Design and Fabrication of All-Plywood Beams—APA H–815E (PDS Supplement #5), 1995.

Panel Design Specification—APA D410A, 2004.

Design and Fabrication of Glued Plywood-Lumber Beams—APA–S 812Q, Suppl. 2–1992.

Design and Fabrication of Plywood Curved Panels—APA–S 811M, Suppl. 1, 1990.

Design and Fabrication of Plywood Sandwich Panels—APA–U 814H, Suppl. 4, 1990.

Voluntary Product Standard, Performance Standard for Wood-based Structural Use Panels—PS 2–92, 1992 (also known as NIST Standard PS 2–96).

Design and Fabrication of Plywood Stressed-Skin Panels—APA–U 813L, Suppl. 3, 1990.

National Design Specifications for Wood Construction, 2001 Edition, with Supplement, Design Values for Wood Construction, NDS–2001, ANSI/AFPA.

Wood Structural Design Data, 1989, Revised 1992, AFPA.

Span Tables for Joists and Rafters—PS–20–70, 1993, AFPA.

Design Values for Joists and Rafters 1992, AFPA.

Particleboard—ANSI A208.1–1999.

Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors—ANSI/AAMA/NWWDA 101/I.S.2–97.

Standard Test Methods for Puncture and Stiffness of Paperboard, and Corrugated and Solid Fiberboard—ASTM D781, 1973.

Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials—ASTM D 4442–92 (Re-approved 1997), 1997.

Standard Test Methods for Use and Calibration of Hand-Held Moisture Meters—ASTM D4444, 1992.

Other

Standard Specification for Gypsum Wallboard—ASTM C 36/C 36M–99, 1999.

Fasteners

National Evaluation Report, Power Driven Staples, Nails, and Allied Fasteners for Use in All Types of Building Construction—NER–272, 1997.

Unclassified

Minimum Design Loads for Buildings and Other Structures—ASCE 7–1988.

Safety Performance Specifications and Methods of Test for Safety Glazing Materials Used in Building—ANSI Z97.1–1984.

(2) Materials and methods of construction utilized in the design and construction of manufactured homes which are covered by the standards in the following table, or any applicable portion thereof shall comply with these requirements.

(3) Engineering analysis and testing methods contained in these references shall be utilized to judge conformance with accepted engineering practices required in § 3280.303(c).

(4) Materials and methods of installation conforming to these standards shall be considered acceptable when installed in conformance with the requirements of this part.

(5) Materials meeting the standards (or the applicable portion thereof) are considered acceptable unless otherwise specified herein or unless substantial doubt exists as to conformance.

(c) Wood products shall be identified as complying with the appropriate standards.

[40 FR 58752, Dec. 18, 1975, as amended at 42 FR 961, Jan. 4, 1977. Redesignated at 44 FR 20679, Apr. 6, 1979, as amended at 58 FR 55006, Oct. 25, 1993; 59 FR 15113, Mar. 31, 1994; 70 FR 72043, Nov. 30, 2005]

§ 3280.305 Structural design requirements.

(a) *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. Uncompressed finished flooring greater than ⅛ inch in thickness shall not extend beneath load-bearing walls that are fastened to the floor structure.

(b) *Design loads*—(1) *Design dead loads.* Design dead loads shall be the actual dead load supported by the structural assembly under consideration.

(2) *Design live loads.* The design live loads and wind and snow loads shall be as specified in this section 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.

(3) When engineering calculations are performed, allowable unit stresses may be increased as provided in the documents referenced in § 3280.304 except as otherwise indicated in §§ 3280.304(b)(1) and 3280.306(a).

(4) Whenever the roof slope does not exceed 20 degrees, the design horizontal wind loads required by § 3280.305(c)(1) may 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.

(c) *Wind, snow, and roof loads*—(1) *Wind loads—design requirements.* (i) *Standard wind loads (Zone I).* When a manufactured home is not designed to resist the wind loads for high wind areas (Zone II or Zone III) specified in paragraph (c)(1)(ii) of this section, the manufactured home and each of its wind resisting parts and portions shall be designed for horizontal wind loads of not less than 15 psf and net uplift load of not less than 9 psf.

(ii) *Wind loads for high wind areas (Zone II and Zone III).* When designed for high wind areas (Zone II and Zone III), 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:

(A) The design wind loads for Exposure C specified in ANSI/ASCE 7–88, ''Minimum Design Loads for Buildings and Other Structures,'' for a fifty-year recurrence interval, and a design wind speed of 100 mph, as specified for Wind Zone II, or 110 mph, as specified for Wind Zone III (Basic Wind Zone Map); or

(B) The wind pressures specified in the following table:

TABLE OF DESIGN WIND PRESSURES

Element	Wind zone II design wind speed 100 MPH	Wind zone III design wind speed 110 MPH
Anchorage for lateral and vertical stability (See § 3280.306(a)):		
Net Horizontal Drag [1,2]:	[3] ±39 PSF	[3] ±47 PSF
Uplift [4]:	[5] −27 PSF	−32 PSF
Main wind force resisting system:		
Shearwalls, Diaphragms and their Fastening and Anchorage Systems [1,2]	±39 PSF	±47 PSF
Ridge beams and other Main Roof Support Beams (Beams supporting expanding room sections, etc.)	−30 PSF	−36 PSF
Components and cladding:		
Roof trusses [4] in all areas; trusses shall be doubled within 3′-0′ from each end of the roof	[5] −39 PSF	[5] −47 PSF
Exterior roof coverings, sheathing and fastenings [4,6,7] in all areas except the following	[5] −39 PSF	[5] −47 PSF
Within 3′-0′ from each gable end (overhang at end wall) of the roof or endwall if no overhang is provided [4,6,7]	[5] −73 PSF	[5] −89 PSF
Within 3′-0′ from the ridge and eave (overhang at sidewall) or sidewall if no eave is provided [4,6,7]	[5] −51 PSF	[5] −62 PSF
Eaves (Overhangs at Sidewalls) [4,6,7]	[5] −51 PSF	[5] −62 PSF
Gables (Overhangs at Endwalls) [4,6,7]	[5] −73 PSF	[5] −89 PSF
Wall studs in sidewalls and endwalls, exterior windows and sliding glass doors (glazing and framing), exterior coverings, sheathing and fastenings [8]:		
Within 3′-0′ from each corner of the sidewall and endwall	±48 PSF	±58 PSF
All other areas	±38 PSF	±46 PSF

NOTES:

[1] The net horizontal drag of ±39 PSF to be used in calculating Anchorage for Lateral and Vertical Stability and for the design of Main Wind Force Resisting Systems is based on a distribution of wind pressures of +0.8 or +24 PSF to the windward wall and −0.5 or −15 PSF to the leeward wall.

[2] Horizontal drag pressures need not be applied to roof projections when the roof slope does not exceed 20 degrees.

[3] + sign would mean pressures are acting towards or on the structure; − sign means pressures are acting away from the structure; ±sign means forces can act in either direction, towards or away from the structure.

[4] Design values in this ''Table'' are only applicable to roof slopes between 10 degrees (nominal 2/12 slope) and 30 degrees.

[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 6 fasteners per shingle through an underlayment which is cemented to a 3/8'' structural rated roof sheathing need not be evaluated for these design wind pressures.

[7] Structural rated roof sheathing that is at least 3/8'' in thickness, installed with the long dimension perpendicular to roof framing supports, and secured with fasteners at 4'' on center within 3′-0′ of each gable end or endwall if no overhang is provided and 6'' on center in all other areas, need not be evaluated for these design wind pressures.

[8] Exterior coverings that are secured at 6″ o.c. to a 3/8″ structural rated sheathing that is fastened to wall framing members at 6″ on center need not be evaluated for these design wind pressures.

(iii) One-piece metal roofing capable of resisting the design wind pressures for ''Components and Cladding: (Exterior roof coverings)'' in the Table for Design Wind Pressures in this section is allowed to be used without structural sheathing, provided the metal roofing is tested using procedures that have been approved by HUD and that meet all requirements of §§ 3280.303(c) and (g) and 3280.401.

(2) *Wind loads—zone designations.* The Wind Zone and specific wind design load requirements are determined by the fastest basic wind speed (mph) within each Zone and the intended location, based on the Basic Wind Zone Map, as follows:

(i) *Wind Zone I.* Wind Zone I consists of those areas on the Basic Wind Zone Map that are not identified in paragraphs (c)(2)(ii) or (iii) of this section as being within Wind Zone II or III, respectively.

(ii) *Wind Zone II*.....100 mph. The following areas are deemed to be within Wind Zone II of the Basic Wind Zone Map:

Local governments: The following local governments listed by State (counties, unless specified otherwise):

Alabama: Baldwin and Mobile.

Florida: All counties except those identified in paragraph (c)(1)(i)(C) of this section as within Wind Zone III.

Georgia: Bryan, Camden, Chatham, Glynn, Liberty, McIntosh.

Louisiana: Parishes of Acadia, Allen, Ascension, Assumption, Calcasieu, Cameron, East Baton Rouge, East Feliciana, Evangeline, Iberia, Iberville, Jefferson Davis, LaFayette, Livingston, Pointe Coupee, St. Helena, St. James, St. John the Baptist, St. Landry, St. Martin, St. Tammany, Tangipahoa, Vermillion, Washington, West Baton Rouge, and West Feliciana.

Maine: Hancock and Washington.

Massachusetts: Barnstable, Bristol, Dukes, Nantucket, and Plymouth.

Mississippi: George, Hancock, Harrison, Jackson, Pearl River, and Stone.

North Carolina: Beaufort, Brunswick, Camden, Chowan, Columbus, Craven, Currituck, Jones, New Hanover, Onslow, Pamlico, Pasquotank, Pender, Perquimans, Tyrrell, and Washington.

South Carolina: Beaufort, Berkeley, Charleston, Colleton, Dorchester, Georgetown, Horry, Jasper, and Williamsburg.

Texas: Aransas, Brazoria, Calhoun, Cameron, Chambers, Galveston, Jefferson, Kenedy, Kleberg, Matagorda, Nueces, Orange, Refugio, San Patricio, and Willacy.

Virginia: Cities of Chesapeake, Norfolk, Portsmouth, Princess Anne, and Virginia Beach.

(iii) *Wind Zone III*.....110 mph. The following areas are considered to be within Wind Zone III of the Basic Wind Zone Map:

(A) *States and Territories:* The entire State of Hawaii, the coastal regions of Alaska (as determined by the 90 mph isotach on the ANSI/ASCE 7–88 map), and all of the U.S. Territories of American Samoa, Guam, Northern Mariana Islands, Puerto Rico, Trust Territory of the Pacific Islands, and the United States Virgin Islands.

(B) *Local governments:* The following local governments listed by State (counties, unless specified otherwise):

Florida: Broward, Charlotte, Collier, Dade, Franklin, Gulf, Hendry, Lee, Martin, Manatee, Monroe, Palm Beach, Pinellas, and Sarasota.

Louisiana: Parishes of Jefferson, La Fourche, Orleans, Plaquemines, St. Bernard, St. Charles, St. Mary, and Terrabonne.

North Carolina: Carteret, Dare, and Hyde.

(iv) *Consideration of local requirements.* For areas where local building code requirements exceed the design wind speed requirements of these standards, the Department will consider the adoption through rulemaking of the more stringent requirements of the State or local building authority.

(3) *Snow and roof loads.* (i) Flat, curved and pitched roofs shall be designed to resist the following live loads, applied downward on the horizontal projection as appropriate for the design zone marked on the manufactured home:

Zone (see Map in § 3280.305(c)(4))	Pounds per square foot
North Zone	40
Middle Zone	30
South Zone	20

(A) *North Roof Load Zone.* The following counties in each of the following states are deemed to be within the North Roof Load Zone:

Maine—Aroostook, Piscataquis, Somerset, Penobscot, Waldo, Knox, Hancock, and Washington.

Alaska—All Counties

(B) *Middle Roof Load Zone*. The following counties in each of the following states are deemed to be within the Middle Roof Load Zone:

States	Counties			
South Dakota	Grant Codington Deuel Hamlin Kingsbury	Brookings Miner Lake Moody McCook	Hanson Minnehaha Hutchinson Turner	Lincoln Yankton Union Clay
Minnesota	Koochiching Itasca Hubbard Cass Crow Wing Aitkin St. Louis Lake Cook Carlton Pine Wadena Todd Morrison Douglas Grant Stevens Pope	Stearns Swift Kandiyohi Meeker Wright Lac qui Parle Chippewa Yellow Medicine Mille Lacs Kanabec Benton Isanti Sherburne Anoka Chisapo Washington Hennepin Ramsey	Renville McLeod Carver Dakota Goodhue Wabasha Winona Fillmore Mower Olmsted Dodge Rice Steele Freeborn Faribault Waseca Le Sueur Scott	Sibley Nicollet Blue Earth Martin Watonwan Brown Redwood Lyon Lincoln Pipestone Murray Cottonwood Jackson Nobles Rock
Iowa	Hancock Lyon Osceola Dickinson Emmet Kossuth Winnebago Worth	Mitchell Howard Chickasaw Butler Floyd Cerro Gordo Franklin Hardin	Hamilton Webster Calhoun Sac Ida Humboldt Pocahontas Palo Alto	Buena Vista Cherokee Plymouth Sioux O'Brien Clay Wright
Wisconsin	Douglas Bayfield Ashland Iron Vilas Forest Florence Marinette St. Croix	Oconto Menominee Langlade Marathon Clark Jackson Trempealeau Buffalo	Pepin Pierce Dunn Eau Claire Chippewa Rusk Barron Taylor	Lincoln Oneida Polk Burnett Washburn Sawyer Price Door
Michigan	Houghton Baraga Marquette Alger Luce Chippewa Keweenaw Ontonagon Gogebic	Iron Dickinson Menominee Delta Schoolcraft Mackinac Cheyboygan Emmet Crawford	Presque Isle Charlevoix Montmorency Alpena Alcona Ogemaw Roscommon Missaukee	Wexford Benzie Grand Traverse Kalkaska Oscoda Otsego Leelanau Antrim
New York	St. Lawrence Franklin Clinton Essex Hamilton Warren Saratoga Washington	Herkimer Lewis Oswego Jefferson Oneida Fulton Montgomery Schenectady	Onondaga Madison Cayuga Seneca Wayne Ontario Yates Livingston	Genesee Orleans Niagara Erie Wyoming Monroe
Massachusetts	Essex			
Maine	Franklin Oxford	Kennebec Androscoggin	Lincoln Sagadahoc	Cumberland York
Montana	All Counties			
Idaho	All Counties			

States	Counties			
Colorado	All Counties			
Wyoming	All Counties			
Utah	All Counties			
Vermont	Franklin Grand Isle Lamoille	Orleans Essex Chittenden	Caledonia Washington Orange	Addison Rutland Windsor
New Hampshire	All Counties			

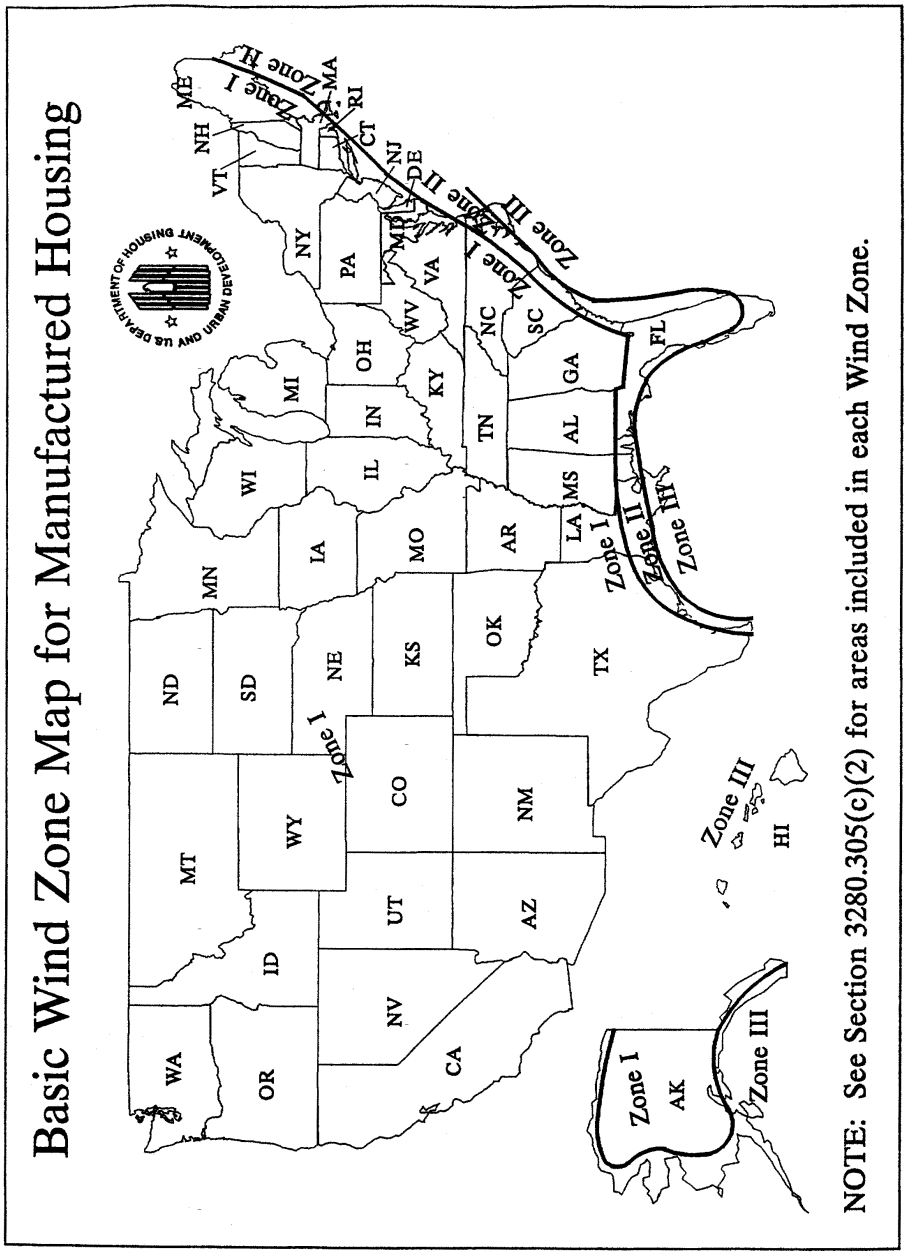
(C) *South Roof Load Zone*. The states and counties that are not listed for the North Roof Load Zone in paragraph (c)(3)(i)(A) of this section, or the Middle Roof Load Zone in paragraph (c)(3)(i)(B) of this section, are deemed to be within the South Roof Load Zone.

(ii) For exposures in areas (mountainous or other) where snow or wind records or experience indicate significant differences from the loads stated above, the Department may establish more stringent requirements for homes known to be destined for such areas. For snow loads, such requirements are to be based on a roof 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.

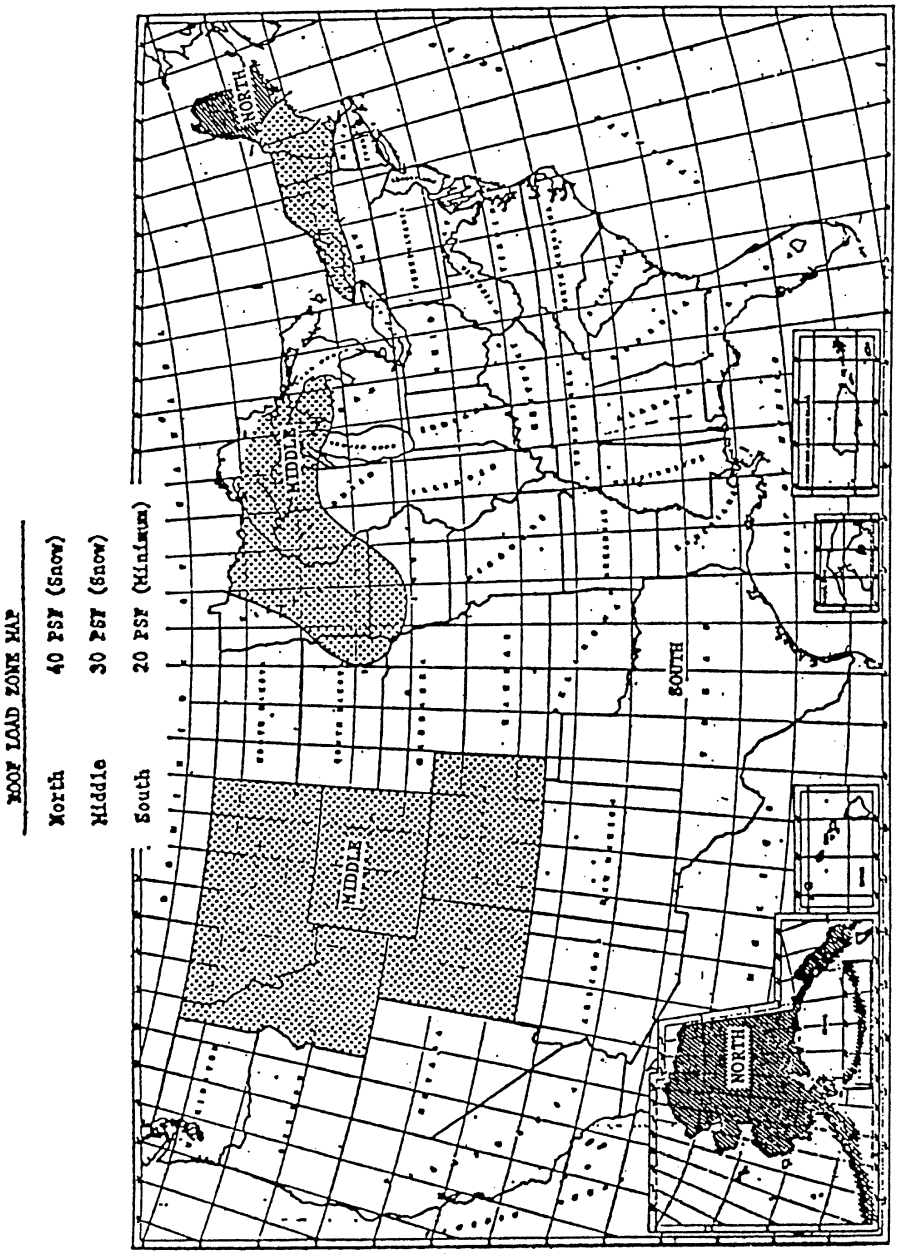
(iii) Eaves and cornices shall be designed for a net uplift pressure of 2.5 times the design uplift wind pressure cited in § 3280.305(c)(1)(i) for Wind Zone I, and for the design pressures cited in § 3280.305(c)(1)(ii) for Wind Zones II and III.

(iv) Skylights must be capable of withstanding roof loads as specified in paragraphs (c)(3)(i) or (c)(3)(ii) of this section. Skylights must be listed and tested in accordance with AAMA 1600/I.S.7–00, 2003, Voluntary Specification for Skylights.

(4) *Data plate requirements*. The Data Plate posted in the manufactured home (see § 3280.5) 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 the Load Zone Maps shown in this paragraph (c)(4), with any related information. The Load Zone Maps shall be not less than either 3½ in. by 2¼ in., or one-half the size illustrated in the Code of Federal Regulations.



NOTE: See Section 3280.305(c)(2) for areas included in each Wind Zone.



ROOF LOAD ZONE MAP	
North	40 PSF (Snow)
Middle	30 PSF (Snow)
South	20 PSF (Minimum)

(d) *Design load deflection.* (1) When a structural assembly is subjected to total design live loads, 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):

Floor—L/240
Roof and ceiling—L/180
Headers, beams, and girders (vertical load)—L/180
Walls and partitions—L/180

(2) The allowable eave or cornice deflection for uplift is to be measured at the design uplift load of 9 psf for Wind Zone I, and at the design uplift pressure cited in paragraph (c)(1)(ii) of this section for Wind Zones II and III. The allowable deflection shall be (2×Lc)/180, where Lc is the measured horizontal eave projection from the wall.

(e) *Fastening of structural systems.* (1) Roof framing must 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 in order to resist wind overturning, uplift, and sliding, and to provide continuous load paths for these forces to the foundation or anchorage system. The number and type of fasteners used must be capable of transferring all forces between elements being joined.

(2) For Wind Zone II and Wind Zone III, roof framing members must 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 must be secured at the vertical bearing points to wall framing members (studs), and wall framing members (studs) must be secured to floor framing members, with 0.016 inch base metal, minimum steel strapping or engineered connectors, or by a combination of 0.016 inch base metal, minimum steel strapping or engineered connectors, and structural-rated wall sheathing that overlaps the roof and floor system if substantiated by structural analysis or by suitable load tests. Steel strapping or engineered connectors are to be installed at a maximum spacing of 24 inches on center in Wind Zone II, and 16 inches on center in Wind Zone III. *Exception:* Where substantiated by structural analysis or suitable load tests, the 0.016 inch base metal minimum steel strapping or engineered connectors may be omitted at the roof to wall and/or wall to floor connections, when structural rated sheathing that overlaps the roof and wall and/or wall and floor is capable of resisting the applicable design wind loads.

(f) *Walls.* The walls shall be of sufficient strength to withstand the load requirements as defined in § 3280.305(c) of this part, without exceeding the deflections as specified in § 3280.305(d). 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.

(1) Except where substantiated by engineering analysis or tests, studs shall not be notched or drilled in the middle one-third of their length.

(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 five pounds per square foot. An allowable stress increase of 1.33 times the permitted published design values may be used in the design of wood framed interior partitions. Finish of walls and partitions shall be securely fastened to wall framing.

(g) *Floors.* (1) Floor assemblies shall be designed in accordance with accepted engineering practice standards to support a minimum uniform live load of 40 lb/ft^2 plus the dead load of the materials. In addition (but not simultaneously), floors shall be able to support a 200–pound concentrated load on a one-inch diameter disc at the most critical location with a maximum deflection not to exceed one-eighth inch relative to floor framing. Perimeter wood joists of more than six inches depth shall be stabilized against overturning from superimposed loads as follows: at ends by solid blocking not less than two-inch thickness by full depth of joist, or by connecting to a continuous header not less than two-inch thickness and not less than the depth of the joist with connecting devices; at eight-feet maximum intermediate spacing by solid blocking or by wood cross-bridging of not less than one inch by three inches, metal cross-bridging of equal strength, or by other approved methods.

(2) Wood, wood fiber or plywood floors or subfloors in kitchens, bathrooms (including toilet compartments), laundry areas, 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. Use of one of the following methods would meet this requirement:

(i) Sealing the floor with a water-resistant sealer; or

(ii) Installing an overlay of a non-absorbent floor covering material applied with water-resistant adhesive; or

(iii) Direct application of a water-resistant sealer to the exposed wood floor area when covered with a non-absorbent overlay; or

(iv) The use of a non-absorbent floor covering which may 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; and

(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; and

(C) The covering is fastened around the perimeter of the subfloor in accordance with the floor covering manufacturer's instructions; and,

(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 this paragraph (g). The vertical edges of penetrations for plumbing shall be covered with a moisture-resistant adhesive or sealant. The vertical penetrations located under the bottom plates of perimeter walls of rooms, areas, or compartments are not required to be sealed; this does not include walls or partitions within the rooms or areas.

(3) Wood panel products used as floor or subfloor materials on the exterior of the home, such as in recessed entryways, must be rated for exterior exposure and protected from moisture by sealing or applying nonabsorbent overlay with water resistant adhesive.

(4) Carpet or carpet pads shall not be installed under concealed spaces subject to excessive moisture, such as plumbing fixture spaces, floor areas under installed laundry equipment. Carpet may be installed in laundry space provided:

(i) The appliances are not provided;

(ii) The conditions of paragraph (g)(2) of this section are followed; and

(iii) Instructions are provided to remove carpet when appliances are installed.

(5) Except where substantiated by engineering analysis or tests:

(i) Notches on the ends of joists shall not exceed one-fourth the joist depth.

(ii) Holes bored in joists shall not be within 2 inches 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.

(iii) 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) Bottom board material (with or without patches) shall meet or exceed the level of 48 inch-pounds of puncture resistance as tested by the Beach Puncture Test in accordance with Standard Test Methods for Puncture and Stiffness of Paperboard, and Corrugated and Solid Fiberboard, ASTM D–781–1968 (73). The material shall be suitable for patches and the patch life shall be equivalent to the material life. Patch installation instruction shall be included in the manufactured home manufacturer's instructions.

(h) *Roofs*. (1) Roofs shall be of sufficient strength to withstand the load requirements as defined in § 3280.305 (b) and (c) without exceeding the deflections specified in § 3280.305(d). The connections between roof framework members and bearing walls shall be fabricated in such a manner to provide for the transfer of design vertical and horizontal loads to the bearing walls and to resist uplift forces.

(2) Roofing membranes shall be of sufficient rigidity to prevent deflection which would permit ponding of water or separation of seams due to wind, snow, ice, erection or transportation forces.

(3) Cutting of roof framework members for passage of electrical, plumbing or mechanical systems shall not be allowed except where substantiated by engineering analysis.

(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 5/16 inch plywood, with exterior glues, secured to the roof framing system beneath the metal roof, and shall be of a size to assure that all screws securing the flashing are held by the backer plate.

(i) *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 shall also be capable of withstanding the effects of transportation shock and vibration without degradation as required by subpart J.

(1) [Reserved]

(2) *Protection of metal frames against corrosion*. Metal frames shall be made corrosion resistant or protected against corrosion. Metal frames may be protected against corrosion by painting.

(j) *Welded connections*. (1) All welds must be made in accordance with the applicable provisions of the Specification for Structural Steel Buildings, Allowable Stress Design and Plastic Design, AISC–S335, 1989; the Specification for the Design of Cold-Formed Steel Structural Members, AISI, 1996; and the Specification for the Design of Cold-Formed Stainless Steel Structural Members, SEI/ASCE 8–02, 2002.

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

(i) Drawbar and coupling mechanisms;

(ii) Main member splices, and

(iii) Spring hanger to main member connections.

[40 FR 58752, Dec. 18, 1975. Redesignated at 44 FR 20679, Apr. 6, 1979, as amended at 44 FR 66195, Nov. 19, 1979; 52 FR 4582, Feb. 12, 1987; 58 FR 55006, Oct. 25, 1993; 59 FR 2469, Jan. 14, 1994; 59 FR 15113, 15114, Mar. 31, 1994; 62 FR 54547, Oct. 20, 1997; 70 FR 72043, Nov. 30, 2005; 71 FR 19638, Apr. 17, 2006]

§ 3280.306 Windstorm protection.

(a) *Provisions for support and anchoring systems*. Each manufactured home shall have provisions for support/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. For Wind Zone I, the design wind loads to be used for calculating resistance to overturning and lateral movement shall be the simultaneous application of the wind loads indicated in § 3280.305(c)(1)(i), increased by a factor of 1.5. The 1.5 factor of safety for Wind Zone I is also to be applied simultaneously to both the vertical building projection, as horizontal wind load, and across the surface of the full roof structure, as uplift loading. For Wind Zones II and III, the resistance shall be determined by the simultaneous application of the horizontal drag and uplift wind loads, in accordance with § 3280.305(c)(1)(ii). 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 need to be applied in the design of the tiedown system. The dead load of the structure may be used to resist these wind loading effects in all Wind Zones.

(1) The provisions of this section shall be followed and the support and anchoring systems shall be designed by a Registered Professional Engineer or Architect.

(2) The manufacturer of each manufactured home is required to make provision for the support and anchoring systems but is not 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 need be provided on the main frame structure.

(b) *Contents of instructions.* (1) The manufacturer must provide printed instructions with each manufactured home that specify the location and required capacity of stabilizing devices on which the home's design is based. The manufacturer must identify by paint, label, decal stencil, or other means: the location of each column support pier location required along the marriage line(s) of multi-section manufactured homes; each pier location required along the perimeter of the home; each required shear wall pier support; and any other special pier support locations specified in the manufacturer's printed instructions. Such identifications must be visible after the home is installed. The manufacturer must 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.

(2) For anchoring systems, the instructions shall indicate:

(i) The minimum anchor capacity required;

(ii) That anchors should 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 paragraph (c)(3) of this section) and angle of anchor installation, and type of soil in which the anchor is to be installed;

(iii) That ground anchors are to be embedded below the frost line, unless the foundation system is frost-protected in accordance with §§ 3285.312(b) and 3285.404 of the Model Manufactured Home Installation Standards in this chapter.

(iv) That ground anchors must be installed to their full depth, and stabilizer plates must be installed in accordance with the ground anchor listing or certification to provide required resistance to overturning and sliding.

(v) That anchoring equipment should be certified by a registered professional engineer or architect to resist these specified forces in accordance with testing procedures in ASTM Standard Specification D3953–91, Standard Specification for Strapping, Flat Steel and Seals.

(c) *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 § 3280.305(c)(1).

(2) Ties shall be as evenly spaced as practicable along the length of the manufactured home, with not more than two (2) feet 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 may 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.

(d) *Requirements for ties.* Manufactured homes in Wind Zone I 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 and III shall have a vertical tie installed at each diagonal tie location.

(e) *Protection requirements.* Protection shall be provided at sharp corners where the anchoring system requires the use of external straps or cables. Protection shall also be provided to minimize damage to siding by the cable or strap.

(f) *Anchoring equipment—load resistance.* Anchoring equipment shall be capable of resisting an allowable working load equal to or exceeding 3,150 pounds and shall be capable of withstanding a 50 percent overload (4,725 pounds total) without failure of either the anchoring equipment or the attachment point on the manufactured home.

(g) *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 ounces per square foot of surface coated, and in accordance with the following:

(1) Slit or cut edges of zinc-coated steel strapping do not need to be zinc coated.

(2) Type 1, Finish B, Grade 1 steel strapping, 1–1/4 inches wide and 0.035 inches in thickness, certified by a registered professional engineer or architect as conforming with ASTM Standard Specification D3953–91, Standard Specification for Strapping, Flat Steel, and Seals.

[40 FR 58752, Dec. 18, 1975. Redesignated at 44 FR 20679, Apr. 6, 1979, as amended at 52 FR 4583, Feb. 12, 1987; 59 FR 2473, Jan. 14, 1994; 70 FR 72045, Nov. 30, 2005; 72 FR 59362, Oct. 19, 2007]

§ 3280.307 Resistance to elements and use.

(a) Exterior coverings shall be of moisture and weather resistive 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 assembled to protect against the infiltration of air and water, except for any designed ventilation of wall or roof cavity.

(b) Joints between dissimilar materials and joints between exterior coverings and frames of openings shall be protected with a compatible sealant suitable to resist infiltration of air or water.

(c) Where adjoining materials or assemblies of materials are of such nature that separation can occur due to expansion, contraction, wind loads or other loads induced by erection or transportation, sealants shall be of a type that maintains protection against infiltration or penetration by air, moisture or vermin.

(d) Exterior surfaces shall be sealed to resist the entrance of rodents.

§ 3280.308 Formaldehyde emission controls for certain wood products.

(a) *Formaldehyde emission levels.* All plywood and particleboard materials bonded with a resin system or coated with a surface finish containing formaldehyde shall not exceed the following formaldehyde emission levels when installed in manufactured homes:

(1) Plywood materials shall not emit formaldehyde in excess of 0.2 parts per million (ppm) as measured by the air chamber test method specified in § 3280.406.

(2) Particleboard materials shall not emit formaldehyde in excess of 0.3 ppm as measured by the air chamber test specified in § 3280.406.

(b) *Product certification and continuing qualification.* All plywood and particleboard materials to be installed in manufactured homes which are bonded with a resin system or coated with a surface finish containing formaldehyde, other than an exclusively phenol-formaldehyde resin system or finish, shall be certified by a nationally recognized testing laboratory as complying with paragraph (a) of this section.

(1) Separate certification shall be done for each plant where the particleboard is produced or where the plywood or particleboard is surface-finished.

(2) To certify plywood or particleboard, the testing laboratory shall witness or conduct the air chamber test specified in § 3280.406 on randomly selected panels initially and at least quarterly thereafter.

(3) The testing laboratory must approve a written quality control plan for each plant where the particleboard is produced or finished or where the plywood is finished. The quality control plan must be designed to assure that all panels comply with paragraph (a) of this section. The plan must establish ongoing procedures to identify increases in the formaldehyde emission characteristics of the finished product resulting from the following changes in production.

(i) In the case of plywood:

(A) The facility where the unfinished panels are produced is changed;

(B) The thickness of the panels is changed so that the panels are thinner; or

(C) The grooving pattern on the panels is changed so that the grooves are deeper or closer together.

(ii) In the case of particleboard:

(A) The resin formulation is changed so that the formaldehyde-to-urea ratio is increased;

(B) The amount of formaldehyde resin used is increased; or

(C) The press time is decreased.

(iii) In the case of plywood or particleboard:

(A) The finishing or top coat is changed and the new finishing or top coat has a greater formaldehyde content; or

(B) The amount of finishing or top coat used on the panels is increased, provided that such finishing or top coat contains formaldehyde.

(4) The testing laboratory shall periodically visit the plant to monitor quality control procedures to assure that all certified panels meet the standard.

(5) To maintain its certification, plywood or particleboard must be tested by the air chamber test specified in § 3280.406 whenever one of the following events occurs:

(i) In the case of particleboard, the resin formulation is changed so that the formaldehyde-to-urea ratio is increased; or

(ii) In the case of particleboard or plywood, the finishing or top coat is changed and the new finishing or top coat contains formaldehyde; or

(iii) In the case of particleboard or plywood, the testing laboratory determines that an air chamber test is necessary to assure that panels comply with paragraph (a) of this section.

(6) In the event that an air chamber test measures levels of formaldehyde from plywood or particleboard in excess of those permitted under paragraph (a) of this section, then the tested product's certification immediately lapses as of the date of production of the tested panels. No panel produced on the same date as the tested panels or on any day thereafter may be used or certified for use in manufactured homes.

(i) Provided, however, that a new product certification may be obtained by testing randomly selected panels which were produced on any day following the date of production of the tested panels. If such panels pass the air chamber test specified in § 3280.406, then the plywood or particleboard produced on that day and subsequent days may be used and certified for use in manufactured homes.

(ii) Provided further, that plywood or particleboard produced on the same day as the tested panels, and panels produced on subsequent days, if not certified pursuant to paragraph (b)(4)(i) of this section, may be used in manufactured homes only under the following circumstances:

(A) Each panel is treated with a scavenger, sealant, or other means of reducing formaldehyde emissions which does not adversely affect the structural quality of the product; and

(B) Panels randomly selected from the treated panels are tested by and pass the air chamber test specified in § 3280.406.

(c) *Panel identification.* Each plywood and particleboard panel to be installed in manufactured homes which is bonded or coated with a resin system containing formaldehyde, other than an exclusively phenol-formaldehyde resin system, shall be stamped or labeled so as to identify the product manufacturer, date of production and/or lot number, and the testing laboratory certifying compliance with this section.

(d) *Treatment after certification.* If certified plywood or particleboard subsequently is treated with paint, varnish, or any other substance containing formaldehyde, then the certification is no longer valid. In such a case, each stamp or label placed on the panels pursuant to paragraph (c) of this section must be obliterated. In addition, the treated panels may be recertified and reidentified in accordance with paragraphs (b) and (c) of this section.

[49 FR 32011, Aug. 9, 1984]

§ 3280.309 Health Notice on formaldehyde emissions.

(a) Each manufactured home shall have a Health Notice on formaldehyde emissions prominently displayed in a

temporary manner in the kitchen (i.e., countertop or exposed cabinet face). The Notice shall read as follows:

IMPORTANT HEALTH NOTICE

Some of the building materials used in this home emit formaldehyde. Eye, nose, and throat irritation, headache, nausea, and a variety of asthma-like symptoms, including shortness of breath, have been reported as a result of formaldehyde exposure. Elderly persons and young children, as well as anyone with a history of asthma, allergies, or lung problems, may be at greater risk. Research is continuing on the possible long-term effects of exposure to formaldehyde.

Reduced ventilation resulting from energy efficiency standards may allow formaldehyde and other contaminants to accumulate in the indoor air. Additional ventilation to dilute the indoor air may be obtained from a passive or mechanical ventilation system offered by the manufacturer. Consult your dealer for information about the ventilation options offered with this home.

High indoor temperatures and humidity raise formaldehyde levels. When a home is to be located in areas subject to extreme summer temperatures, an air-conditioning system can be used to control indoor temperature levels. Check the comfort cooling certificate to determine if this home has been equipped or designed for the installation of an air-conditioning system.

If you have any questions regarding the health effects of formaldehyde, consult your doctor or local health department.

(b) The Notice shall be legible and typed using letters at least ¼ inch in size. The title shall be typed using letters at least ¾ inch in size.

(c) The Notice shall not be removed by any party until the entire sales transaction has been completed (refer to part 3282—Manufactured Home Procedural and Enforcement Regulations for provisions regarding a sales transaction).

(d) A copy of the Notice shall be included in the Consumer Manual (refer to part 3283—Manufactured Home Consumer Manual Requirements).

[49 FR 32012, Aug. 9, 1984, as amended at 54 FR 46049, Nov. 1, 1989; 58 FR 55007, Oct. 25, 1993]

Subpart E—Testing

§ 3280.401 Structural load tests.

Every structural assembly tested shall be capable of meeting the Proof Load Test or the Ultimate Load Test as follows:

(a) *Proof load tests.* Every structural assembly tested must be capable of sustaining its dead load plus superimposed live loads equal to 1.75 times the required live loads for a period of 12 hours without failure. Tests must be conducted with loads applied and deflections recorded in ¼ design live load increments at 10-minute intervals until 1.25 times design live load plus dead load has been reached. Additional load shall then be applied continuously until 1.75 times design live load plus dead load has been reached. Assembly failure shall be considered as design live load deflection (or residual deflection measured 12 hours after live load removal) that is greater than the limits set in § 3280.305(d), rupture, fracture, or excessive yielding. Design live load deflection criteria do not apply when the structural assembly being evaluated does not include structural framing members. An assembly to be tested shall be of the minimum quality of materials and workmanship of the production. Each test assembly, component, or subassembly shall be identified as to type and quality or grade of material. All assemblies, components, or subassemblies qualifying under this test shall be subject to a continuing qualification testing program acceptable to HUD.

(b) *Ultimate load tests.* Ultimate load tests must be performed on a minimum of three assemblies or components to generally evaluate the structural design. Every structural assembly or component tested must be capable of sustaining its total dead load plus the design live load increased by a factor of safety of at least 2.5. A factor of safety greater than 2.5 shall be used when required by an applicable reference standard in § 3280.304(b)(1). Tests shall be conducted with loads applied and deflections recorded in 1/4 design live load increments at 10-minute intervals until 1.25 times design live load plus dead load has been reached. Additional loading shall then be applied continuously until failure occurs, or the total of the factor of safety times the design live load plus the dead load is reached. Assembly failure shall be considered as design live load deflection greater than

the limits set in § 3280.305(d), rupture, fracture, or excessive yielding. Design live load deflection criteria do not apply when the structural assembly being evaluated does not include structural framing members. Assemblies to be tested shall be representative of average quality or materials and workmanship of the production. Each test assembly, component, or subassembly shall be identified as to type and quality or grade of material. All assemblies, components, or subassemblies qualifying under this test shall be subject to a periodic qualification testing program acceptable to HUD.

[40 FR 58752, Dec. 18, 1975. Redesignated at 44 FR 20679, Apr. 6, 1979, as amended at 58 FR 55007, Oct. 25, 1993; 70 FR 72045, Nov. 30, 2005]

§ 3280.402 Test procedure for roof trusses.

(a) *Roof load tests.* The following is an acceptable test procedure, consistent with the provisions of § 3280.401, for roof trusses that are supported at the ends and support design loads. Where roof trusses act as support for other members, act as cantilevers, or support concentrated loads, they shall be tested accordingly.

(b) *General.* Trusses may be tested in pairs or singly in a suitable test facility. When tested singly, simulated lateral support of the test assembly may be provided, but in no case shall this lateral support exceed that which is specified for the completed manufactured home. When tested in pairs, the trusses shall be spaced at the design spacing and shall be mounted on solid support accurately positioned to give the required clear span distance (L) as specified in the design. The top and bottom chords shall be braced and covered with the material, with connections or method of attachment, as specified by the completed manufactured home.

(1) As an alternate test procedure, the top chord may be sheathed with ¼ inch by 12 inch plywood strips. The plywood strips shall be at least long enough to cover the top chords of the trusses at the designated design truss spacing. Adjacent plywood strips must be separated by at least ⅛ inch. The plywood strip shall be nailed with 4d nails or equivalent staples not closer than 8 inches on center along the top chord. The bottom chords of the adjacent trusses may be either:

(i) Unbraced,

(ii) Laterally braced together (not cross braced) with 1″ × 2″ stripping not closer than 24 inches on center nailed with only one 6d nail at each truss, or

(iii) Covered with the material, with connections or methods of attachment, as specified for the completed manufactured home.

(2) Truss deflections will be measured relative to a taut wire running over the support and weighted at the end to insure constant tension or other approved methods. Deflections will be measured at the two quarter points and at midspan. Loading shall be applied to the top chord through a suitable hydraulic, pneumatic, or mechanical system, masonry units, or weights to simulate design loads. Load units for uniformly distributed loads shall be separated so that arch action does not occur, and shall be spaced not greater than 12 inches on center so as to simulate uniform loading.

(c) *Nondestructive test procedure*—(1) *Dead load plus live load.* (i) Noting figure A–1, measure and record initial elevation of the truss in test position at no load.

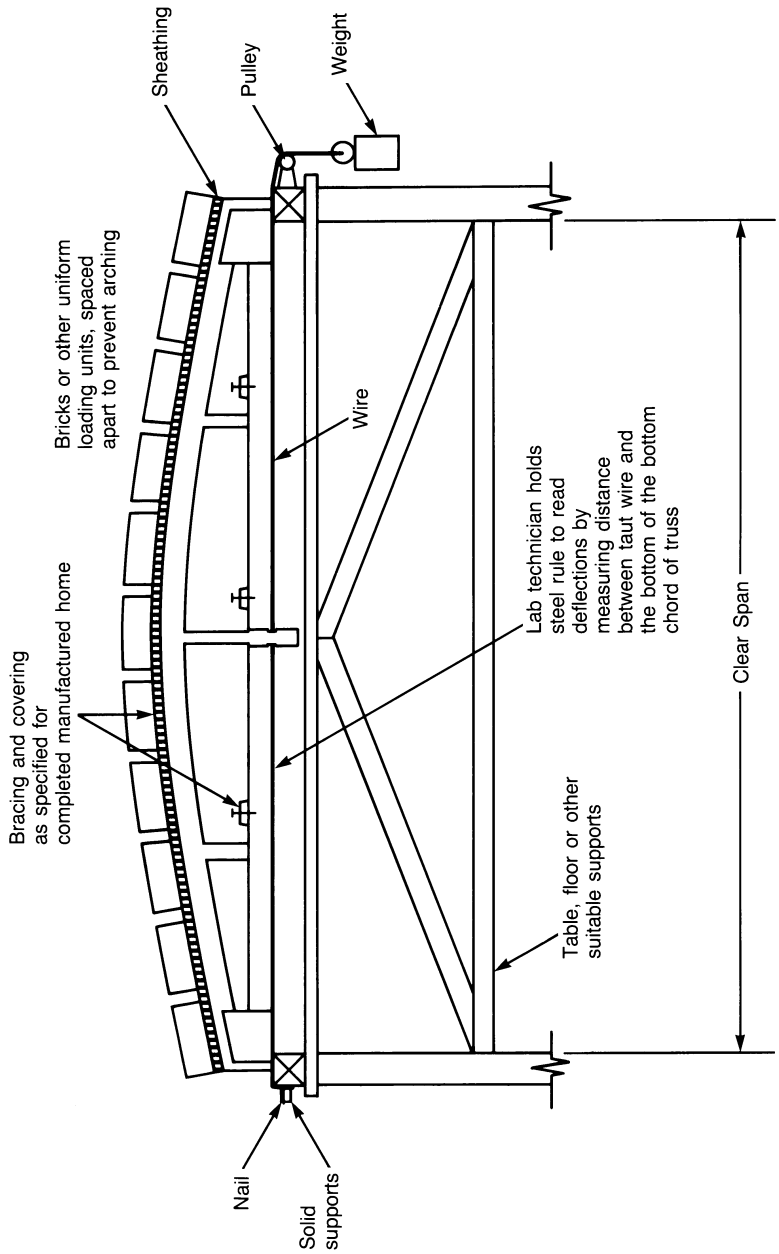


Figure A-1. Test Procedures for Roof Trusses

(ii) Apply load units to the top chord of the truss equal to the full dead load of roof and ceiling. Measure and record deflections.

(iii) Maintaining the dead load, add live load in approximate ¼ design live load increments. Measure the deflections after each loading increment.

Apply incremental loads at a uniform rate such that approximately one-half hour is required to establish the total design load condition. Measure and record the deflections five minutes after loads have been applied. The maximum deflection due to design live load (deflection measured in step (iii) minus step (ii)) shall not exceed L/180, where L is a clear span measured in the same units.

(iv) Continue to load truss to dead load plus 1.75 times the design live load. Maintain this loading for 12 hours and inspect the truss for failure.

(v) Remove the total superimposed live load. Trusses not recovering to at least the L/180 position within 12 hours shall be considered as failing.

(2) *Uplift loads*. This test shall only be required for truss designs which may be critical under uplift load conditions.

(i) Measure and record initial elevation of the truss in an inverted test position at no load. Bottom chord of the truss shall be mounted in the horizontal position.

(ii) Apply the uplift load as stated in § 3280.305(c) to the bottom chord of the truss. Measure and record the deflections 5 minutes after the load has been applied.

(iii) Continue to load the truss to 1.75 times the design uplift load. Maintain this load for 3 hours and inspect the truss for failure.

(iv) Remove applied loads and within three hours the truss must recover to at least L/180 position, where L is a clear span measured in the same units.

(d) *Destructive test procedure*. (1) Destructive tests shall be performed on three trusses to generally evaluate the truss design.

(2) Noting figure A–1, apply the load units to the top chord of the truss assembly equal to full dead load of roof and ceiling. Measure and record deflections. Then apply load and record deflections in ¼ design live load increments at 10-minute intervals until 1.25 times design live load plus dead load has been reached.

(3) Additional loading shall then be applied continuously until failure occurs or the factor of safety times the design live load plus the dead load is reached.

(4) Assembly failure shall be considered as design live load deflection greater than the limits set in § 3280.305(d), rupture, fracture, or excessive yielding.

(5) The assembly shall be capable of sustaining the dead load plus the applicable factor of safety times the design live load (the applicable factor of safety for wood trusses shall be taken as 2.50).

(e) Trusses qualifying under the nondestructive test procedure. Tests § 3208.402(c) (1) and (2) (when required), shall be subject to a continuing qualification testing program acceptable to the Department. Trusses qualifying under the destructive test procedures, Tests § 3280.402 (c)(2) (when required), and (d), shall be subject to periodic tests only.

[40 FR 58752, Dec. 18, 1975, as amended at 42 FR 961, Jan. 4, 1977. Redesignated at 44 FR 20679. Apr. 6, 1979, as amended at 58 FR 55008, Oct. 25, 1993]

EFFECTIVE DATE NOTE: At 78 FR 4065, Jan. 18, 2013, § 3280.402 was revised, effective Jan. 13, 2014. For the convenience of the user, the revised text is set forth as follows:

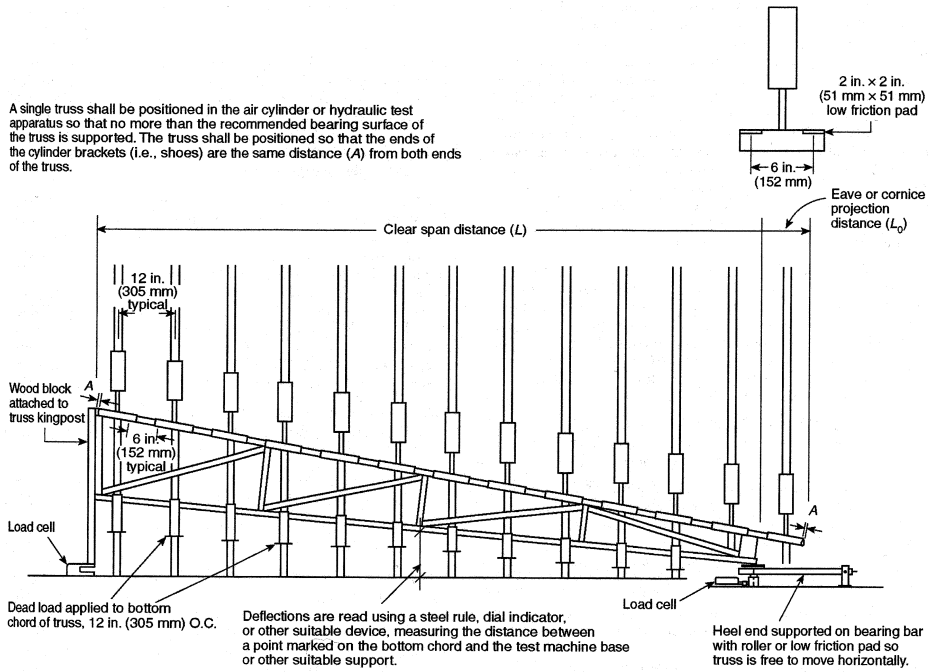
§ 3280.402 Test procedures for roof trusses.

(a) *Roof load tests*. This section provides the roof truss test procedure for vertical loading conditions. Where roof trusses act as support for other members, have eave or cornice projections, or support concentrated loads, roof trusses must also be tested for those conditions. These test procedures are required for new truss designs in all three wind zones and for existing truss designs used in Wind Zones II and III.

(b) *General*. Trusses must be tested in a truss test fixture that replicates the design loads, and actual support points, and does not restrain horizontal movement. When tested singly or in groups of two or more trusses, trusses shall be mounted on supports and positioned as intended to be installed in the manufactured home in order to give the required clear span distance (L) and eave or cornice distance (Lo), if applicable, as specified in the design.

(1) When trusses are tested singly, trusses shall be positioned in a test fixture, with supports properly located and the roof loads evenly applied. See Figure 3280.402(b)(1).

Figure 3280.402(b)(1) – Test fixture for testing trusses singly

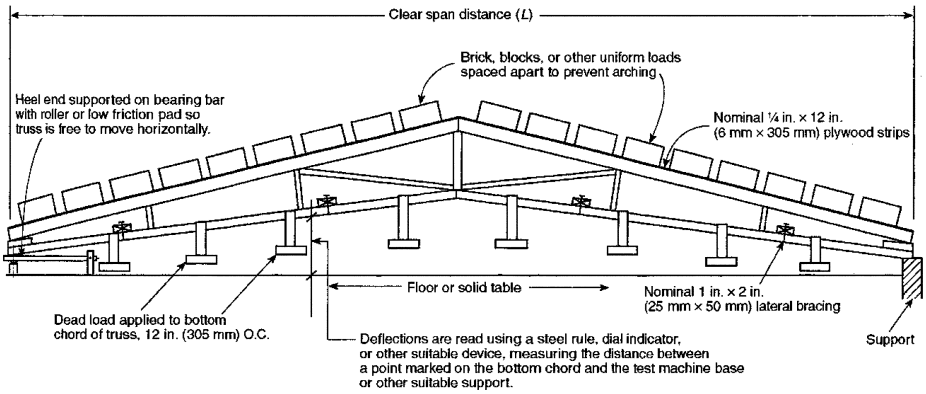


(2) When tested in groups of two or more, the top chords are permitted to be sheathed with nominal 1/4-inch x 12-inch plywood strips. The plywood strips shall be at least long enough to cover the top chords of the trusses at the designated design truss spacing. Adjacent plywood strips shall be separated by at least 1/8-inch. The plywood strips shall be nailed with 4d nails or equivalent staples no closer than 8 inches on center along the top chord. The bottom chords of the adjacent trusses shall be permitted to be one of the following:

(i) Unbraced; or

(ii) Laterally braced together (not cross-braced) with 1-inch x 2-inch stripping no closer than 24 inches on center, nailed with only one 8d nail at each truss. See Figure 3280.402(b)(2).

Figure 3280.402(b)(2) – Test set-up for roof trusses tested in groups of two or more



(c) *Measuring and loading methods.* Deflections must be measured at the free end of an eave or cornice projection and at least at the truss mid-span and quarter points. Scissors or other unique truss configurations are to be measured at as many additional bottom chord panel points as necessary to obtain an accurate representation of the deflected shape of the truss so as to be able to locate and record the point(s) of maximum deflection. Deflections must be read and recorded relative to a fixed reference datum. Deflections must be read and recorded to the nearest 1/32-inch. Dead load must be applied to the top and bottom chord, and live load must be applied to the top chord through a suitable hydraulic, pneumatic, or mechanical system or weights to simulate design loads. Load unit weights for uniformly distributed top chord loads must be separated so that arch action does not occur and be spaced not more than 12 inches on center so as to simulate uniform loading. Bottom chord loading must be spaced as uniformly as practical. Truss gravity loads must be calculated based on the overall truss length (horizontal projection), including eave or cornice projections.

(d) *Testing procedures.* Either the testing method in paragraph (d)(1) or (d)(2) of this section may be used, however, the testing method in paragraph (d)(3) of this section must be used, to test trusses to establish compliance with the provisions of these standards.

(1) *Proof load truss test procedure.* At least three average quality/consecutively tested trusses must pass all requirements of the test, for initial qualification of the truss design. All tests for initial qualification of the truss designs evaluated by this procedure must be certified by a Registered Engineer or Architect, or by a nationally recognized testing laboratory. An in-house quality control and follow-up testing program (see paragraphs (e) and (f) of this section) must be approved prior to entering production of any truss design evaluated by this procedure.

(i) *Dead load.* Measure and record initial elevation of the truss or trusses in the test position at no load. Apply to the top and bottom chords of the truss dead loads that are representative of the actual weights of materials to be supported by the truss. However, the dead load may only be applied as indicated in paragraph (e)(4) of this section for ongoing follow-up testing. Dead loads to be applied to the truss test assembly are permitted to include only the weights of materials supported by the truss and not the weight of the truss itself. However, readings from load cells (when used) on which the test truss rests must reflect the sum of the applied load plus the weight of the truss. Apply dead loads and hold for 5 minutes. Measure and record the deflections.

(ii) *Live load.* Maintaining the dead loads, apply live load to the top chord in approximate ¼ live load increments until dead load plus the live load is reached. Measure and record the deflections no sooner than one minute after each ¼ live load increment has been applied and 5 minutes after the full live load has been reached.

(iii) *Initial recovery phase.* Remove the design live load but not the dead load. Measure and record the deflections 5 minutes after the total live load has been removed.

(iv) Continue to load the truss to:

(A) Dead load plus 2.0 times the design live load. Maintain this loading for 6 hours and inspect the truss for failure. Failure is rupture, fracture, or excessive yielding; or

(B) Dead load plus 1.75 times the design live load. Maintain this loading for 12 hours

and inspect the truss for failure. Failure is rupture, fracture, or excessive yielding.

(v) *Final recovery phase.* Remove 2.0 times the design live load, but not the dead load or 1.75 times the design live load, but not the dead load. Measure and record deflections within 4 hours after removing 2.0 times the design live load or 1.75 times the design live load.

(vi) *Acceptance criteria.* The truss design is acceptable if all of the following conditions are met:

(A) The maximum deflection between no load and dead load must be L/480 or less for simply supported clear spans and Lo/180 or less for eave and cornice projections; and

(B) The maximum deflection between dead load and design live load must be L/180 or less for simply supported clear spans and Lo/90 or less for eave and cornice projections; and

(C) After the design live load is removed, and with the dead load still applied, the maximum recovery deflection must be L/360 or less for simply supported spans and Lo/180 or less for eave and cornice projections; and

(D) The truss must maintain the overload condition for 6 hours without rupture or fracture, or excessive yielding; and

(E) After 2.0 times the design live load has been removed, and with the dead load still applied, the maximum recovery deflection must be L/180 or less for simply supported clear spans and Lo/90 or less for eave and cornice projections; and

(F) As applicable, each truss design must also meet all requirements for uplift loads required by paragraph (d)(3) of this section. For Wind Zone I uplift load requirements, see paragraph (d)(3)(i) of this section. For Wind Zones II and III uplift load requirements, see paragraph (d)(3)(ii) of this section.

(2) *Ultimate load truss test procedure.* (i) At least two average quality/consecutively tested trusses must pass all requirements of the test, for initial qualification of the truss design. All tests for initial qualification of the truss designs evaluated by this procedure must be certified by a Registered Engineer or Architect, or by a nationally recognized testing laboratory. An in-house quality control and follow-up testing program (see paragraph (e) and (f) of this section) must be approved prior to entering production of any truss design evaluated by this procedure.

(ii) *Dead load.* Measure and record initial elevation of the truss or trusses in the test position at no load. Apply to the top and bottom chords of the truss dead loads that are representative of the actual weights of materials to be supported by the truss. However, the dead load may only be applied as indicated in paragraph (e)(4) of this section for ongoing follow-up testing. Dead loads to be applied to the truss test assembly shall be permitted to include only the weights of materials supported by the truss, and not the weight of the truss itself. However, readings from load cells (when used) on which the test truss rests must reflect the sum of the applied load plus the weight of the truss. Apply dead loads and hold for 5 minutes. Measure and record the deflections.

(iii) *Live load.* Maintaining the dead loads, apply live load at a uniform rate to the top chord in approximate ¼ live load increments until the dead load plus the live load is reached. Measure and record the deflections no sooner than one minute after each ¼ live load increment has been applied and 5 minutes after the full live load has been reached.

(iv) *Initial recovery phase.* Remove the design live load but not the dead load. Measure and record the deflections 5 minutes after the design live load has been removed.

(v) *Overload phase.* After the recovery phase is completed, reapply the full live load to the truss assembly. Additional loading shall then be applied continuously until the dead load plus 2.5 times the design live load is reached. This overload condition must be maintained for at least 5 minutes.

(vi) *Final recovery phase.* Remove 2.5 times the design live load but not the dead load. Measure and record deflections within 4 hours after 2.5 times the design live load has been removed.

(vii) *Acceptance criteria.* The truss design is acceptable if all of the following conditions are met:

(A) The maximum deflection between no load and dead load must be L/480 or less for simply supported clear spans and Lo/180 or less for eave and cornice projections; and

(B) Dead load to design live load deflections shall be L/180 or less for simply supported clear spans and Lo/90 or less for eave and cornice projections; and

(C) After the design live load is removed and with the dead load still applied, the maximum recovery deflection must be L/360 or less for simply supported spans and Lo/180 or less for eave and cornice projections; and

(D) The truss shall maintain the overload condition for 5 minutes without rupture, fracture, or excessive yielding; and

(E) After 2.5 times the design live load is removed, and with the dead load still applied, the truss must recover to at least L/180 for simply supported clear spans and Lo/90 for eave and cornice within 4 hours after the total live load has been removed; and

(F) As applicable, each truss design must also meet all requirements for uplift loads in Wind Zone I or Wind Zone II and III, as required by paragraph (d)(3) of this section. For Wind Zone I uplift load requirements, see paragraph (d)(3)(i) of this section. For Wind Zones II and III uplift load requirements, see paragraph (d)(3)(ii) of this section.

(3) *Uplift load tests.* Each truss design must also pass all requirements of the uplift load

test, as applicable, in paragraph (d)(3)(i) or (d)(3)(ii) and paragraphs (d)(3)(iii) and (d)(3)(iv) of this section.

(i) *Wind Zone I uplift load test.* Where there are engineered connectors between the top chord and web members of the truss, such as metal connector plates or wood gussets or their equivalents, uplift testing in Wind Zone I is at the discretion of the Registered Engineer or Architect or nationally recognized testing laboratory certifying the truss design. When testing is deemed necessary by the Registered Engineer or Architect or nationally recognized testing laboratory certifying the truss design, a minimum of one average quality uplift load test is to be conducted for each such truss design and must pass all requirements of the test for initial qualification of the truss design. The net uplift load for trusses designed for use in Wind Zone I is 9 psf for the clear span of the truss and 22.5 psf for eave or cornice projections.

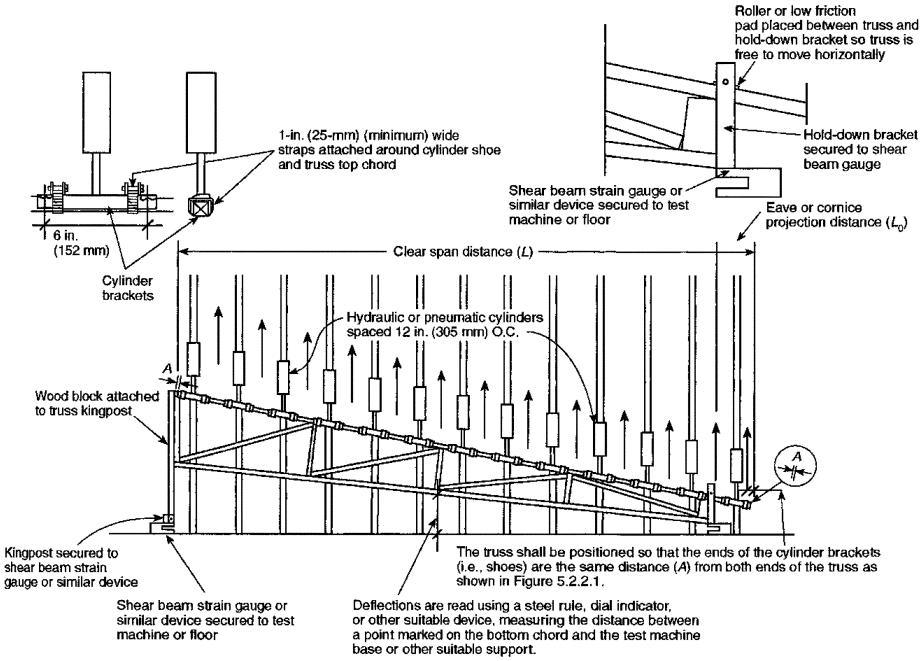
(ii) *Wind Zones II and III uplift loads test.* This test is required for all trusses designed for use in Wind Zones II and III. A minimum of three average quality/consecutive uplift load tests are to be conducted for each truss design when tested in the inverted position and a minimum of two average quality/consecutive uplift load tests are to be conducted for trusses in the upright position. The trusses must pass all requirements of the test for initial qualification of the truss design. The uplift load for trusses designed to be used in Wind Zones II and III for the clear span or eave cornice projections is to be determined by subtracting the dead load applied to the truss from the uplift load provided in the Table of Design Wind Pressures in § 3280.305(c)(1)(ii)(B).

(iii) Trusses designed for use in Wind Zone I, when tested (see paragraph (d)(3)(i) of this section), must be tested in either the inverted position to 2.5 times the net wind uplift load or in the upright position to 1.75 times the net wind uplift load. Trusses designed for use in Wind Zones II and III (see paragraph (d)(3)(ii) of this section) must be tested to 2.0 times the uplift load minus the dead load in the inverted position and to 1.75 times the uplift load minus the dead load in the upright position. See Figure 3280.402(b)(3).

(iv) The following describes how to conduct the uplift test with the truss in the upright position. Similar procedures must be used if conducting the test in the inverted position.

(A) Place the truss in the test fixture and position as it is intended to be installed in the manufactured home. See Figure 3280.402(b)(3).

Figure 3280.402(b)(3) – Test setup for roof trusses tested for uplift in the upright position



(B) Position the load measurement devices to register the wind uplift loads that will be applied to the top chord of the truss. The uplift loads shall be applied through tension devices not wider than one inch and spaced not greater than approximately 12 inches on center and shall be applied as uniform as possible, so as to simulate uniform loading. Gravity and wind uplift load tests may be performed on the same truss in this single setup mode. For the wind uplift test, it is permissible to stabilize the bottom chord of the truss in the test fixture to simulate ceiling materials or purlin supports. Measure and record the initial elevation of the bottom chord of the truss in the test position at the mid-span and quarter points of the truss, and at the free end of an eave or cornice projection greater than 12 inches. Scissors or other unique truss configurations are to be measured at as many additional bottom chord panel points as necessary to obtain an accurate representation of the deflected shape of the truss, so as to be able to locate and record the point(s) of maximum deflection. Eave or cornice projection loads are applied separately for eaves or cornice projections greater than 12 inches. For eave or cornice projections greater than 12 inches, the additional required load must be applied to the eave simultaneously with the main body load. For eave or cornice projections of 12 inches or less, add the additional required load to the main body load and apply it to the entire top chord.

(C) Measure and record the deflection 5 minutes after the net uplift load has been applied. Design load deflection shall be L/180 or less for a simply supported clear span and Lo/90 or less for eave or cornice projections.

(D) For trusses tested in the upright position, continue to load the truss to 1.75 times the net uplift load in paragraph (d)(3)(i) of this section for Wind Zone I and 1.75 times the uplift load in paragraph (d)(3)(ii) for Wind Zones II and III, and maintain the load for one minute. For trusses tested in the inverted position, continue to load the truss to 2.50 times the net uplift load in paragraph (d)(3)(i) for Wind Zone I and to 2.0 times the uplift load minus the dead load in paragraph (d)(3)(ii) for Wind Zones II and III, and maintain the full load for one minute. Regardless of the test position of the truss, upright or inverted, trusses must maintain the overload for the specified time period without rupture, fracture, or excessive yielding.

(e) *Follow-up testing.* Follow-up testing procedures must include the following:

(1) All trusses qualifying under these test procedures must be subject to a quality control and follow-up testing program.

(i) Manufacturers of listed or labeled trusses must follow an in-house quality control program with follow-up testing approved by a nationally recognized testing program as specified in paragraph (e)(3) of this section. The in-house quality control program must include, at a minimum, procedures for quality of materials including, but not limited to, grade(s) of materials, allowable splits, knots, and other applicable lumber qualities; workmanship including, but not limited to, plate placement and embedment tolerances; other manufacturing tolerances; description and calibration of test equipment; truss retesting criteria; and procedures in the event of noncomplying results.

(ii) Those home manufacturers producing trusses for their own use, and which are not listed or labeled, must have an in-house quality control program (see paragraph (i) of this section) that includes follow-up testing, as specified in this section, and is approved by their Design Approval Primary Inspection Agency (DAPIA).

(2) Truss designs that are qualified but not in production are not subject to follow-up testing until produced. When the truss design is brought into production, a follow-up test is to be performed if the truss design has been out of production for more than 6 months.

(3) The frequency of truss manufacturer's quality control follow-up testing for trusses must be at least:

(i) One test for the first 100 trusses produced, with a subsequent test for every 2,500 trusses for trusses qualified under the proof load truss test procedure or inverted uplift test procedure for trusses used in Wind Zones II and III or once every 6 months, whichever is more frequent, for every truss design produced; or

(ii) One test for every 4,000 trusses produced for trusses qualified under the ultimate load truss test procedure or upright uplift test procedure for trusses used in Wind Zones II and III or once every 6 months, whichever is more frequent, for every truss design produced.

(4) For follow-up testing only, the full dead load may be applied to the top chord of the truss, when the bottom chord dead load is 5 psf or less.

§ 3280.403 Standard for windows and sliding glass doors used in manufactured homes.

(a) *Scope*. This section sets the requirements for prime windows and sliding glass doors except for windows used in entry doors. Windows so mounted are components of the door and thus are excluded from this standard.

(b) *Standard*. All primary windows and sliding glass doors shall comply with AAMA 1701.2–95, Voluntary Standard Primary Window and Sliding Glass Door for Utilization in Manufactured Housing, except the exterior and interior pressure tests must be conducted at the design wind loads required for components and cladding specified in § 3280.305(c)(1).

(c) *Installation*. All primary windows and sliding glass doors shall be installed in a manner which allows proper operation and provides protection against the elements (*see* § 3280.307).

(d) *Glass*. (1) Safety glazing materials, where used, shall meet ANSI Z97.1–1984, ''Safety Performance Specifications and Methods of Test for Safety Glazing Materials Used in Buildings.''

(2) Sealed insulating glass, where used, must meet all performance requirements for Class C in accordance with ASTM E 774–97, Standard Specification for the Classification of the Durability of Sealed Insulating Glass Units. The sealing system must be qualified in accordance with ASTM E 773–97, Standard Test Methods for Accelerated Weathering of Sealed Insulating Glass Units. Each glass unit must be permanently identified with the name of the insulating glass manufacturer.

(e) *Certification*. All primary windows and sliding glass doors to be installed in manufactured homes must be certified as complying with AAMA 1701.2–95. This certification must be based on tests conducted at the design wind loads specified in § 3280.305(c)(1).

(1) All such windows and doors must show evidence of certification by affixing a quality certification label to the product in accordance with ANSI Z34.1–1993, Third-Party Certification Programs for Products, Processes, and Services.

(2) In determining certifiability of the products, an independent quality assurance agency shall conduct preproduction specimen tests in accordance with AAMA 1701.2–95. Further, such agency must inspect the product manufacturer's facility at least twice per year.

(f) *Protection of primary window and sliding glass door openings in high wind*

areas. For homes designed to be located in Wind Zones II and III, manufacturers shall design exterior walls surrounding the primary window and sliding glass door openings to allow for the installation of shutters or other protective covers, such as plywood, to cover these openings. Although not required, the Department encourages manufacturers to provide the shutters or protective covers and to install receiving devices, sleeves, or anchors for fasteners to be used to secure the shutters or protective covers to the exterior walls. If the manufacturer does not provide shutters or other protective covers to cover these openings, the manufacturer must provide to the homeowner instructions for at least one method of protecting primary window and sliding glass door openings. This method must be capable of resisting the design wind pressures specified in § 3280.305 without taking the home out of conformance with the standards in this part. These instructions must be included in the printed instructions that accompany each manufactured home. The instructions shall also indicate whether receiving devices, sleeves, or anchors, for fasteners to be used to secure the shutters or protective covers to the exterior walls, have been installed or provided by the manufacturer.

[52 FR 4583, Feb. 12, 1987, as amended at 52 FR 35543, Sept. 22, 1987; 58 FR 55009, Oct. 25, 1993; 59 FR 2474, Jan. 14, 1994; 70 FR 72046, Nov. 30, 2005]

§ 3280.404 Standard for egress windows and devices for use in manufactured homes.

(a) *Scope and purpose*. The purpose of this section is to establish the requirements for the design, construction, and installation of windows and approved devices intended to be used as an emergency exit during conditions encountered in a fire or similar disaster.

(b) *Performance*. Egress windows including auxiliary frame and seals, if any, shall meet all requirements of AAMA 1701.2–95, Voluntary Standard Primary Window and Sliding Glass Door for Utilization in Manufactured Housing and AAMA Standard 1704–1985, Voluntary Standard Egress Window Systems for Utilization in Manufactured Housing, except the exterior and interior pressure tests for components and cladding must be conducted at the design wind loads required by § 3280.305(c)(1).

(c) *Installation*. (1) The installation of egress windows or devices shall be installed in a manner which allows for proper operation and provides protection against the elements. (*See* § 3280.307.)

(2) An operational check of each installed egress window or device shall be made at the manufactured home factory. All egress windows and devices shall be openable to the minimum required dimension without binding or requiring the use of tools. Any window or device failing this check shall be repaired or replaced. A repaired window shall conform to its certification. Any repaired or replaced window or device shall pass the operational check.

(d) *Operating instructions*. Operating instructions shall be affixed to each egress window and device and carry the legend ''Do Not Remove.''

(e) *Certification of egress windows and devices*. Egress windows and devices shall be listed in accordance with the procedures and requirements of AAMA Standard 1704–1985. As of January 17, 1995, this certification must be based on tests conducted at the design wind loads specified in § 3280.305(c)(1).

(f) *Protection of egress window openings in high wind areas*. For homes designed to be located in Wind Zones II and III, manufacturers shall design exterior walls surrounding the egress window openings to allow for the installation of shutters or other protective covers, such as plywood, to cover these openings. Although not required, the Department encourages manufacturers to provide the shutters or protective covers and to install receiving devices, sleeves, or anchors for fasteners to be used to secure the shutters or protective covers to the exterior walls. If the manufacturer does not provide shutters or other protective covers to cover these openings, the manufacturer must provide to the homeowner instructions for at least one method of protecting egress window openings. This method must be capable of resisting the design wind pressures specified in § 3280.305

without taking the home out of conformance with the standards in this part. These instructions must be included in the printed instructions that accompany each manufactured home. The instructions shall also indicate whether receiving devices, sleeves, or anchors, for fasteners to be used to secure the shutters or protective covers to the exterior walls, have been installed or provided by the manufacturer.

[52 FR 4583, Feb. 12, 1987, as amended at 59 FR 2474, Jan. 14, 1994; 70 FR 72046, Nov. 30, 2005]

§ 3280.405 Standard for swinging exterior passage doors for use in manufactured homes.

(a) *Introduction*. This standard applies to all exterior passage door units, excluding sliding doors and doors used for access to utilities and compartments. This standard applies only to the door frame consisting of jambs, head and sill and the attached door or doors.

(b) *Performance requirements*. The design and construction of exterior door units must meet all requirements of AAMA 1702.2–95, Voluntary Standard Swinging Exterior Passage Door for Utilization in Manufactured Housing.

(c) *Materials and methods*. Any material or method of construction shall conform to the performance requirements as outlined in paragraph (b) of this section. Plywood shall be exterior type and preservative treated in accordance with NWWDA I.S.4–81, Water Repellent Preservative Non-Pressure Treatment for Millwork.

(d) *Exterior doors*. All swinging exterior doors shall be installed in a manner which allows proper operation and provides protection against the elements (*see* § 3280.307).

(e) *Certification*. All swinging exterior doors to be installed in manufactured homes must be certified as complying with AAMA 1702.2–95, Voluntary Standard Swinging Exterior Passage Door for Utilization in Manufactured Housing.

(1) All such doors must show evidence of certification by affixing a quality certification label to the product in accordance with ANSI Z34.1–1993, Third Party Certification Programs for Products, Processes, and Services.

(2) In determining certifiability of the products, an independent quality assurance agency must conduct a preproduction specimen test in accordance with AAMA 1702.2–95, Voluntary Standard Swinging Exterior Passage Door for Utilization in Manufactured Housing.

(f) *Protection of exterior doors in high wind areas*. For homes designed to be located in Wind Zones II and III, manufacturers shall design exterior walls surrounding the exterior door openings to allow for the installation of shutters or other protective covers, such as plywood, to cover these openings. Although not required, the Department encourages manufacturers to provide the shutters or protective covers and to install receiving devices, sleeves, or anchors for fasteners to be used to secure the shutters or protective covers to the exterior walls. If the manufacturer does not provide shutters or other protective covers to cover these openings, the manufacturer must provide to the homeowner instructions for at least one method of protecting exterior door openings. This method must be capable of resisting the design wind pressures specified in § 3280.305 without taking the home out of conformance with the standards in this part. These instructions must be included in the printed instructions that accompany each manufactured home. The instructions shall also indicate whether receiving devices, sleeves, or anchors, for fasteners to be used to secure the shutters or protective covers to the exterior walls, have been installed or provided by the manufacturer.

[40 FR 58752, Dec. 18, 1975. Redesignated at 44 FR 20679, Apr. 6, 1979, as amended at 52 FR 4583, Feb. 12, 1987; 52 FR 35543, Sept. 22, 1987; 58 FR 55009, Oct. 25, 1993; 59 FR 2474, Jan. 14, 1994; 70 FR 72046, Nov. 30, 2005]

§ 3280.406 Air chamber test method for certification and qualification of formaldehyde emission levels.

(a) *Preconditioning*. Preconditioning of plywood or particleboard panels for air chamber tests shall be initiated as soon as practicable but not in excess of 30 days after the plywood or particleboard is produced or surface-finished, whichever is later, using randomly selected panels.

(1) If preconditioning is to be initiated more than two days after the plywood or particleboard is produced or surface-finished, whichever is later, the panels must be dead-stacked or airtight wrapped until preconditioning is initiated.

(2) Panels selected for testing in the air chamber shall not be taken from the top or bottom of the stack.

(b) *Testing*. Testing must be conducted in accordance with the Standard Test Method for Determining Formaldehyde Levels from Wood Products Under Defined Test Conditions Using a Large Chamber, ASTM E 1333–96, with the following exceptions:

(1) The chamber shall be operated indoors.

(2) Plywood and particleboard panels shall be individually tested in accordance with the following loading ratios:

(i) Plywood—0.29 Ft2/Ft3, and

(ii) Particleboard—0.13 Ft2/Ft3.

(3) Temperature to be maintained inside the chamber shall be 77° plus or minus 2 °F.

(4) The test concentration (C) shall be standardized to a level (C_O) at a temperature (t_O) of 77 °F and 50% relative humidity (H_O) by the following formula:

$$C = C_O \times [1 + Ax\ (H - H_O)] \times e^{-R(1/t - 1/tO)}$$

where:

C = Test formaldehyde concentration

C_O = Standardized formaldehyde concentration

e = Natural log base

R = Coefficient of temperature (9799)

t = Actual test condition temperature (° K)

t_O = Standardized temperature (° K)

A = Coefficient of humidity (0.0175)

H = Actual relative humidity (%)

H_O = Standardized relative humidity (%)

The standardized level (C_O) is the concentration used to determine compliance with § 3280.308(a).

(5) The air chamber shall be inspected and recalibrated at least annually to insure its proper operation under test conditions.

[49 FR 32012, Aug. 9, 1984, as amended at 58 FR 55009, Oct. 25, 1993; 70 FR 72046, Nov. 30, 2005]

Subpart F—Thermal Protection

§ 3280.501 Scope.

This subpart sets forth the requirements for condensation control, air infiltration, thermal insulation and certification for heating and comfort cooling.

§ 3280.502 Definitions.

(a) The following definitions are applicable to subpart F only:

(1) *Pressure envelope* means that primary air barrier surrounding the living space which serves to limit air leakage. In construction using ventilated cavities, the pressure envelope is the interior skin.

(2) *Thermal envelope area* means the sum of the surface areas of outside walls, ceiling and floor, including all openings. The wall area is measured by multiplying outside wall lengths by the inside wall height from floor to ceiling. The floor and ceiling areas are considered as horizontal surfaces using exterior width and length.

§ 3280.503 Materials.

Materials used for insulation shall be of proven effectiveness and adequate durability to assure that required design conditions concerning thermal transmission are attained.

§ 3280.504 Condensation control and installation of vapor retarders.

(a) *Ceiling vapor retarders*. (1) In U_o Value Zones 2 and 3, ceilings must have a vapor retarder with a permeance of not greater than 1 perm (as measured by ASTM E 96–95 Standard Test Methods for Water Vapor Transmission of Materials) installed on the living space side of the roof cavity.

(2) For manufactured homes designed for Uo Value Zone 1, the vapor retarder may be omitted.

(b) *Exterior walls*. (1) Exterior walls must have a vapor retarder with a permeance no greater than 1 perm (dry cup method) installed on the living space side of the wall; or

(2) Unventilated wall cavities must have an external covering and/or sheathing that forms the pressure envelope. The covering and/or sheathing must have a combined permeance of not less than 5.0 perms. In the absence

of test data, combined permeance is permitted to be computed using the following formula: P total = $(1/[(1/P_1) + (1/P_2)])$, where P_1 and P_2 are the permeance values of the exterior covering and sheathing in perms. Formed exterior siding applied in sections with joints not caulked or sealed, are not considered to restrict water vapor transmission; or

(3) Wall cavities must be constructed so that ventilation is provided to dissipate any condensation occurring in these cavities; or

(4) Homes manufactured to be sited in ''humid climates'' or ''fringe climates'' as shown on the Humid and Fringe Climate Map in this paragraph are permitted to have a vapor retarder specified in paragraph (b)(1) of this section installed on the exterior side of the wall insulation or be constructed with an external covering and sheathing with a combined permeance of not greater than 1.0 perms, provided the interior finish and interior wall panel materials have a combined permeance of not less than 5.0 perms. The following need not meet the minimum combined permeance rating of not less than 5.0 perms for interior finish or wall panel materials:

(i) Kitchen back splash materials, less than 50 square feet in area installed around countertops, sinks, and ranges;

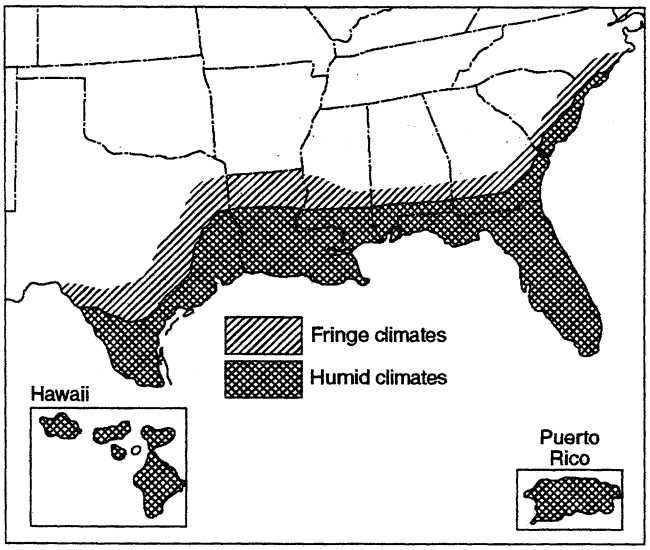
(ii) Bathroom tub areas, shower compartments;

(iii) Cabinetry and built-in furniture;

(iv) Trim materials;

(v) Hardboard wall paneling of less than 50 square feet in area under chair rails.

Humid and Fringe Climate Map



(5) The following areas of local governments (counties or similar areas, unless otherwise specified), listed by state are deemed to be within the humid and fringe climate areas shown on the Humid and Fringe Climate Map in paragraph (b)(4) of this section, and the vapor retarder or construction methods specified in paragraph (b)(4) of this section may be applied to homes built to be sited within these jurisdictions:

ALABAMA

Baldwin, Barbour, Bullock, Butler, Choctaw, Clarke, Coffee, Conecuh, Covington, Crenshaw, Dale, Escambia, Geneva, Henry, Houston, Lowndes, Marengo, Mobile, Monroe, Montgomery, Pike, Washington, Wilcox.

FLORIDA

All counties and locations within the State of Florida.

GEORGIA

Appling, Atkinson, Bacon, Baker, Ben Hill, Berrien, Brantley, Brooks, Bryan, Calhoun, Camden, Charlton, Chatham, Clay, Clinch, Coffee, Colquitt, Cook, Crisp, Decatur, Dougherty, Early, Echols, Effingham, Evans, Glynn, Wayne, Grady, Irwin, Jeff Davis, Lanier, Lee, Liberty, Long, Lowndes, McIntosh, Miller, Mitchell, Pierce, Quitman, Randolph, Seminole, Tattnall, Terrell, Thomas, Tift, Turner, Ware, Worth.

HAWAII

All counties and locations within the State of Hawaii.

LOUISIANA

All counties and locations within the State of Louisiana.

MISSISSIPPI

Adams, Amite, Claiborne, Clarke, Copiah, Covington, Forrest, Franklin, George, Greene, Hancock, Harrison, Hinds, Issaquena, Jackson, Jasper, Jefferson, Jefferson Davis, Jones, Lamar, Lawrence, Lincoln, Marion, Pearl River, Perry, Pike, Rankin, Simpson, Smith, Stone, Walthall, Warren, Wayne, Wilkinson.

NORTH CAROLINA

Brunswick, Carteret, Columbus, New Hanover, Onslow, Pender.

SOUTH CAROLINA

Jasper, Beaufort, Colleton, Dorchester, Charleston, Berkeley, Georgetown, Horry.

TEXAS

Anderson, Angelina, Aransas, Atascosa, Austin, Bastrop, Bee, Bexar, Brazoria, Brazos, Brooks, Burleson, Caldwell, Calhoun, Cameron, Camp, Cass, Chambers, Cherokee, Colorado, Comal, De Witt, Dimmit, Duval, Falls, Fayette, Fort Bend, Franklin, Freestone, Frio, Galveston, Goliad, Gonzales, Gregg, Grimes, Guadalupe, Hardin, Harris, Harrison, Hays, Henderson, Hidalgo, Hopkins, Houston, Jackson, Jasper, Jefferson, Jim Hogg, Jim Wells, Karnes, Kaufman, Kennedy, Kinney, Kleberg, La Salle, Lavaca, Lee, Leon, Liberty, Limestone, Live Oak, Madison, Marion, Matagorda, Maverick, McMullen, Medina, Milam, Montgomery, Morris, Nacogdoches, Navarro, Newton, Nueces, Orange, Panola, Polk, Rains, Refugio, Robertson, Rusk, Sabine, San Augustine, San Jacinto, San Patricio, Shelby, Smith, Starr, Titus, Travis, Trinity, Tyler, Upshur, Uvalde, Val Verde, Van Zandt, Victoria, Walker, Waller, Washington, Webb, Wharton, Willacy, Williamson, Wilson, Wood, Zapata, Zavala.

(c) *Attic or roof ventilation.* (1) Attic and roof cavities shall be vented in accordance with one of the following:

(i) A minimum free ventilation area of not less than 1/300 of the attic or roof cavity floor area. At least 50 percent of the required free ventilation area shall be provided by ventilators located in the upper portion of the space to be ventilated. At least 40 percent shall be provided by eave, soffit or low gable vents. The location and spacing of the vent openings and ventilators shall provide cross-ventilation to the entire attic or roof cavity space. A clear air passage space having a minimum height of 1 inch shall be provided between the top of the insulation and the roof sheathing or roof covering. Baffles or other means shall be provided where needed to insure the 1 inch height of the clear air passage space is maintained.

(ii) A mechanical attic or roof ventilation system may be installed instead of providing the free ventilation area when the mechanical system provides a minimum air change rate of 0.02 cubic feet per minute (cfm) per sq. ft. of attic floor area. Intake and exhaust vents shall be located so as to provide air movement throughout space.

(2) Single section manufactured homes constructed with metal roofs and having no sheathing or underlayment installed, are not required to be provided with attic or roof cavity ventilation provided that the air leakage paths from the living space to the roof cavity created by electrical outlets, electrical junctions, electrical cable penetrations, plumbing penetrations, flue pipe penetrations and exhaust vent penetrations are sealed.

(3) Parallel membrane roof section of a closed cell type construction are not required to be ventilated.

(4) The vents provided for ventilating attics and roof cavities shall be designed to resist entry of rain and insects.

[40 FR 58752, Dec. 18, 1975. Redesignated at 44 FR 20679, Apr. 6, 1979, as amended at 58 FR 55009, Oct. 25, 1993; 70 FR 72046, Nov. 30, 2005; 71 FR 19639, Apr. 17, 2006]

§ 3280.505 Air infiltration.

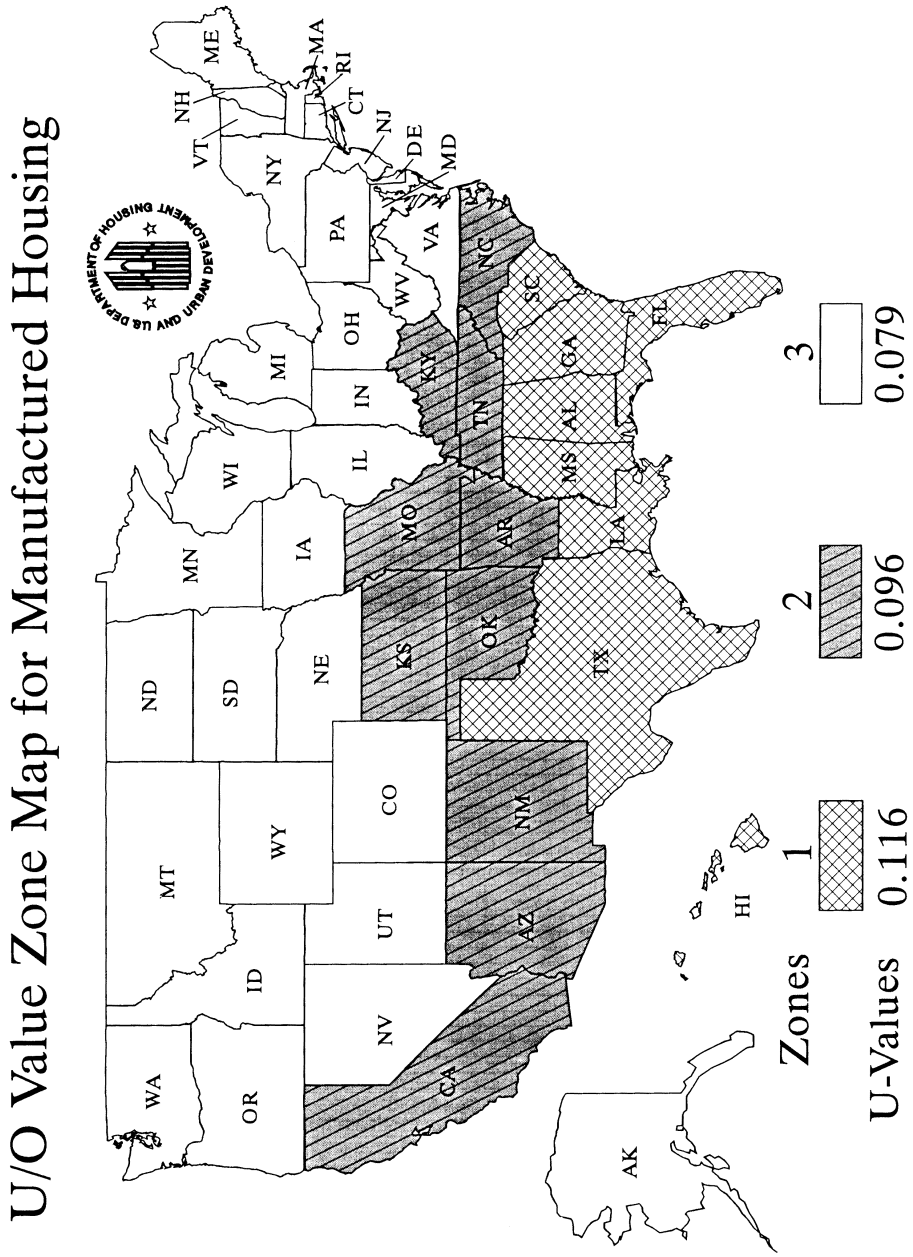
(a) *Envelope air infiltration.* The opaque envelope shall be designed and constructed to limit air infiltration to the living area of the home. Any design, material, method or combination thereof which accomplishes this goal may be used. The goal of the infiltration control criteria is to reduce heat loss/heat gain due to infiltration as much as possible without impinging on health and comfort and within the limits of reasonable economics.

(1) *Envelope penetrations.* Plumbing, mechanical and electrical penetrations of the pressure envelope not exempted by this part, and installations of window and door frames shall be constructed or treated to limit air infiltration. Penetrations of the pressure envelope made by electrical equipment, other than distribution panel boards and cable and conduit penetrations, are exempt from this requirement. Cable penetrations through outlet boxes are considered exempt.

(2) *Joints between major envelope elements.* Joints not designed to limit air infiltration between wall-to-wall, wall-to-ceiling and wall-to-floor connections shall be caulked or otherwise sealed. When walls are constructed to form a pressure envelope on the outside of the wall cavity, they are deemed to meet this requirement.

§ 3280.506 Heat loss/heat gain.

The manufactured home heat loss/heat gain shall be determined by methods outlined in §§ 3280.508 and 3280.509. The Uo (Coefficient of heat transmission) value zone for which the manufactured home is acceptable and the lowest outdoor temperature to which the installed heating equipment will maintain a temperature of 70 F shall be certified as specified in § 3280.510 of this subpart. The Uo value zone shall be determined from the map in figure 506.



(a) *Coefficient of heat transmission.* The overall coefficient of heat transmission (Uo) of the manufactured home for the respective zones and an indoor design temperature of 70 F, including internal and external ducts, and excluding infiltration, ventilation and condensation control, shall not exceed

the Btu/(hr.) (sq. ft.) (F) of the manufactured home envelope are as tabulated below:

Uo value zone	Maximum coefficient of heat transmission
1	0.116 Btu/(hr.) (sq. ft.) (F).
2	0.096 Btu/(hr.) (sq. ft.) (F).
3	0.079 Btu/(hr.) (sq. ft.) (F).

(b) To assure uniform heat transmission in manufactured homes, cavities in exterior walls, floors, and ceilings shall be provided with thermal insulation.

(c) Manufactured homes designed for Uo Value Zone 3 shall be factory equipped with storm windows or insulating glass.

[58 FR 55009, Oct. 25, 1993; 59 FR 15113, Mar. 31, 1994]

§ 3280.507 Comfort heat gain.

Information necessary to calculate the home cooling load shall be provided as specified in this part.

(a) *Transmission heat gains*. Homes complying with this section shall meet the minimum heat loss transmission coefficients specified in § 3280.506(a).

§ 3280.508 Heat loss, heat gain and cooling load calculations.

(a) Information, values and data necessary for heat loss and heat gain determinations must be taken from the 1997 ASHRAE Handbook of Fundamentals, Inch-Pound Edition, chapters 22 through 27. The following portions of those chapters are not applicable:

23.1 Steel Frame Construction
23.2 Masonry Construction
23.3 Foundations and Floor Systems
23.15 Pipes
23.17 Tanks, Vessels, and Equipment
23.18 Refrigerated Rooms and Buildings
24.18 Mechanical and Industrial Systems
25.19 Commercial Building Envelope Leakage
27.9 Calculation of Heat Loss from Crawl Spaces

(b) The calculation of the manufactured home's transmission heat loss coefficient (Uo) must be in accordance with the fundamental principles of the 1997 ASHRAE Handbook of Fundamentals, Inch-Pound Edition, and, at a minimum, must address all the heat loss or heat gain considerations in a manner consistent with the calculation procedures provided in the document, Overall U-values and Heating/Cooling Loads—Manufactured Homes—February 1992–PNL 8006, HUD User No. 0005945.

(c) Areas where the insulation does not fully cover a surface or is compressed shall be accounted for in the U-calculation (see § 3280.506). The effect of framing on the U-value must be included in the Uo calculation. Other low-R-value heat-flow paths (''thermal shorts'') shall be explicitly accounted for in the calculation of the transmission heat loss coefficient if in the aggregate all types of low-R-value paths amount to more than 1% of the total exterior surface area. Areas are considered low-R-value heat-flow paths if:

(1) They separate conditioned and unconditioned space; and

(2) They are not insulated to a level that is at least one-half the nominal insulation level of the surrounding building component.

(d) *High efficiency heating and cooling equipment credit*. The calculated transmission heat loss coefficient (Uo) used for meeting the requirement in § 3280.506(a) may be adjusted for heating and cooling equipment above that required by the National Appliance Energy Conservation Act of 1987 (NAECA) by applying the following formula:

Uo adjusted = Uo standard×[1+(0.6) (heating efficiency increase factor)+(cooling multiplier) (cooling efficiency increase factor)]

where:

Uo standard = Maximum Uo for Uo Zone required by § 3280.506(a)

Uo adjusted = Maximum Uo standard adjusted for high efficiency HVAC equipment

Heating efficiency increase factor = The increase factor in heating equipment efficiency measured by the Annual Fuel Utilization Efficiency (AFUE), or the Heating Seasonal Performance Factor (HSPF) for heat pumps, above that required by NAECA (indicated as ''NAECA'' in formula). The formula is heating efficiency increase factor = AFUE (HSPF) home − AFUE (or HSPF) NAECA divided by AFUE (HSPF) NAECA.

Cooling efficiency increase factor = the increase factor in the cooling equipment

efficiency measured by the Seasonal Energy Efficiency Ratio (SEER) above that required by NAECA.

The formula being cooling equipment=SEER home—SEER NAECA divided by SEER NAECA.

The cooling multiplier for the Uo Zone is from the following table:

Uo zone	Cooling multiplier (Cm)
1	0.60 (Florida only).
1	0.20 (All other locations).
2	0.07.
3	0.03.

(e) U values for any glazing (e.g., windows, skylights, and the glazed portions of any door) must be based on tests using AAMA 1503.1–1988, Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors, and Glazed Wall Sections, or the National Fenestration Rating Council 100, 1997 Edition, Procedure for Determining Fenestration Product U-factors. In the absence of tests, manufacturers are to use the residential window U values contained in Chapter 29, Table 5 of the 1997 ASHRAE Handbook of Fundamentals, Inch-Pound Edition. In the event that the classification of the window type is indeterminate, the manufacturer must use the classification that gives the higher U value. Where a composite of materials from two different product types is used, the product is to be assigned the higher U value. For the purpose of calculating U_o values, storm windows are treated as an additional pane.

(f) *Annual energy used based compliance.* As an alternative, homes may demonstrate compliance with the annual energy used implicit in the coefficient of heat transmission (Uo) requirement. The annual energy use determination must be based on generally accepted engineering practices. The general requirement is to demonstrate that the home seeking compliance approval has a projected annual energy use, including both heating and cooling, less than or equal to a similar ''base case'' home that meets the standard. The energy use for both homes must be calculated based on the same assumptions; including assuming the same dimensions for all boundaries between conditioned and unconditioned spaces, site characteristics, usage patterns and climate.

[58 FR 55011, Oct. 25, 1993, as amended at 70 FR 72047, Nov. 30, 2005]

§ 3280.509 Criteria in absence of specific data.

In the absence of specific data, for purposes of heat-loss/gain calculation, the following criteria shall be used:

(a) *Infiltration heat loss.* In the absence of measured infiltration heat loss data, the following formula shall be used to calculate heat loss due to infiltration and intermittently operated fans exhausting to the outdoors. The perimeter calculation shall be based on the dimensions of the pressure envelope.

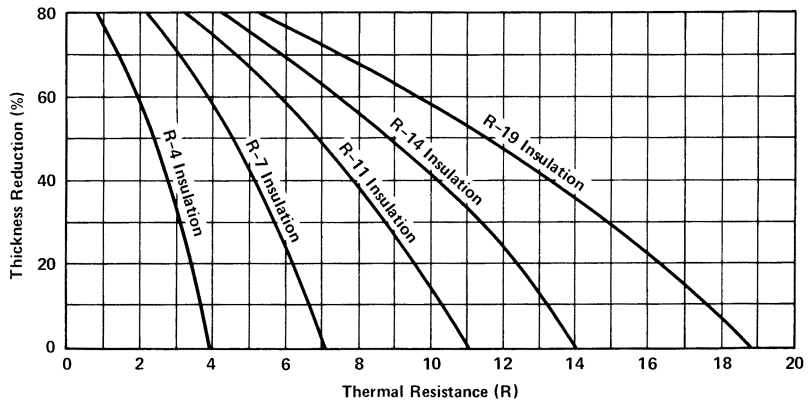
Infiltration Heat-Loss=0.7 (T) (ft. of perimeter), BTU/hr.

where: T=70 minus the heating system capacity certification temperature stipulated in the Heating Certificate, in F.

(b) *Framing areas.*

Wall	15 percent of wall area less windows and doors.
Floor and Ceiling	10 percent of the area.

(c) *Insulation compression.* Insulation compressed to less than nominal thickness shall have its nominal R-values reduced for that area which is compressed in accordance with the following graph:



When insulation is installed over the framing members the thermal performance of the insulation is reduced due to compression at the framing members. The Resistance value of the insulation between the framing members is reduced by 12.5 percent for framing members 16″ O.C., 8.5 percent for framing members 24″ O.C., and 4 percent for framing members 48″ O.C.

(d) *Air supply ducts within floor cavity.* Air supply ducts located within a floor cavity shall be assumed to be heating or cooling the floor cavity to living space temperatures unless the duct is structurally isolated by the framing system or thermally insulated from the rest of the floor cavity with a thermal insulation at least equal to R–4.

(e) *Air supply ducts within ceiling cavity.* Where supply ducts are located in ceiling cavities, the influence of the duct on cavity temperatures shall be considered in calculating envelope heat loss or heat gain.

(f) The supply duct loss (and/or heat gain where applicable—See § 3280.511) shall be calculated using the actual duct surface area and the actual thickness of insulation between the duct and outside of the manufactured home. If there is an air space of at least ½ inch between the duct and the insulation, heat loss/gain need not be calculated if the cavity in which the duct is located is assumed to be at living space temperature. The average temperature inside the supply duct, including ducts installed outside the manufactured home, shall be assumed to be 130 F for purposes of calculation of heat loss and 60 F for heat gain.

(g) *Return air cavities.* Cavities used as return air plenums shall be considered to be at living space temperature.

§ 3280.510 Heat loss certificate.

The manufactured home manufacturer shall permanently affix the following ''Certificate'' to an interior surface of the home that is readily visible to the homeowner. The ''Certificate'' shall specify the following:

(a) *Heating zone certification.* The design zone at which the manufactured home heat loss complies with § 3280.506(a).

(b) *Outdoor certification temperature.* The lowest outdoor temperature at which the installed heating equipment will maintain a 70 °F temperature inside the home without storm sash or insulating glass for Zones 1 and 2, and with storm sash or insulating glass for Zone 3 and complying with § 3280.508 and § 3280.509.

(c) *Operating economy certification temperature.* The temperature to be specified for operating economy and energy conservation shall be 20 °F or 30% of the design temperature difference, whichever is greater, added to the temperature specified as the heating system capacity certification temperature without storm windows or insulating glass in Zones 1 and 2 and with storm windows or insulating glass in Zone 3. Design temperature difference is 70°

minus the heating system capacity certification temperature in degrees Fahrenheit.

HEATING CERTIFICATE

Home Manufacturer _____
Plant Location _____
Home Model _____

(Include Uo Value Zone Map)

This manufactured home has been thermally insulated to conform with the requirements of the Federal Manufactured Home Construction and Safety Standards for all locations within Uo Value Zone ____.

Heating Equipment Manufacturer _____
Heating Equipment Model _____

The above heating equipment has the capacity to maintain an average 70F temperature in this home at outdoor temperatures of [see paragraph (b) of this section] F. To maximize furnace operating economy and to conserve energy, it is recommended that this home be installed where the outdoor winter design temperature (97 1/2%) is not higher than [see paragraph (c) of this section] F degrees Fahrenheit.

The above information has been calculated assuming a maximum wind velocity of 15 MPH at standard atmospheric pressure.

(d) The following additional statement must be provided on the heating certificate and data plate required by § 3280.5 when the home is built with a vapor retarder of not greater than one perm (dry cup method) on the exterior side of the insulation: ''This home is designed and constructed to be sited only in humid or fringe climate regions as shown on the Humid and Fringe Climate Map.'' A reproduction of the Humid and Fringe Climate Map in § 3280.504 is to be provided on the heating certificate and data plate. The map must be not less than 3½ inch × 2¼ inch in size and may be combined with the U_o Value Zone Map for Manufactured Housing in § 3280.506.

[40 FR 58752, Dec. 18, 1975. Redesignated at 44 FR 20679, Apr. 6, 1979, as amended at 58 FR 55011, Oct. 25, 1993; 70 FR 72048, Nov. 30, 2005]

§ 3280.511 Comfort cooling certificate and information.

(a) The manufactured home manufacturer shall permanently affix a ''Comfort Cooling Certificate'' to an interior surface of the home that is readily visible to the home owner. This certificate may be combined with the heating certificate required in § 3280.510. The manufacturer shall comply with one of the following three alternatives in providing the certificate and additional information concerning the cooling of the manufactured home:

(1) *Alternative I.* If a central air conditioning system is provided by the home manufacturer, the heat gain calculation necessary to properly size the air conditioning equipment shall be in accordance with procedures outlined in chapter 22 of the 1989 ASHRAE Handbook of Fundamentals, with an assumed location and orientation. The following shall be supplied in the Comfort Cooling Certificate:

Air Conditioner Manufacturer _____
Air Conditioner Model _____

Certified Capacity _____ BTU/Hr. in accordance with the appropriate Air Conditioning and Refrigeration Institute Standards

The central air conditioning system provided with this home has been sized, assuming an orientation of the front (hitch) end of the home facing _____ and is designed on the basis of a 75 °F indoor temperature and an outdoor temperature of __ °F dry bulb and __ °F wet bulb.

EXAMPLE ALTERNATE I

COMFORT COOLING CERTIFICATE

Manufactured Home Mfg _____
Plant Location _____
Manufactured Home Model _____
Air Conditioner Manufacturer _____

Certified Capacity _____ BTU/Hr. in accordance with the appropriate Air Conditioning and Refrigeration Institute Standards.

The central air conditioning system provided with this home has been sized assuming an orientation of the front (hitch end) of the home facing _____. On this basis, the system is designed to maintain an indoor temperature of 75 °F when outdoor temperatures are __ °F dry bulb and __ °F wet bulb.

The temperature to which this home can be cooled will change depending upon the amount of exposure of the windows to the sun's radiant heat. Therefore, the home's heat gains will vary dependent upon its orientation to the sun and any permanent shading provided. Information concerning the calculation of cooling loads at various locations, window exposures and shadings are provided in chapter 22 of the 1989 edition of the ASHRAE Handbook of Fundamentals.

(2) *Alternative 2.* For each home suitable for a central air cooling system,

the manufacturer shall provide the following statement: ''This air distribution system of this home is suitable for the installation of a central air conditioning system.''

EXAMPLE ALTERNATE 2

COMFORT COOLING CERTIFICATE

Manufactured Home Manufacturer _____
Plant Location _____
Manufactured Home Model _____

This air distribution system of this home is suitable for the installation of central air conditioning.

The supply air distribution system installed in this home is sized for Manufactured Home Central Air Conditioning System of up to _____ B.T.U./Hr. rated capacity which are certified in accordance with the appropriate Air Conditioning and Refrigeration Institute Standards. When the air circulators of such air conditioners are rated at 0.3 inch water column static pressure or greater for the cooling air delivered to the manufactured home supply air duct system.

Information necessary to calculate cooling loads at various locations and orientations is provided in the special comfort cooling information provided with this manufactured home.

(3) *Alternative 3.* If the manufactured home is not equipped with an air supply duct system, or if the manufacturer elects not to designate the home as being suitable for the installation of a central air conditioning system, the manufacturer shall provide the following statement: ''This air distribution system of this home has not been designed in anticipation of its use with a central air conditioning system.''

EXAMPLE ALTERNATE 3

COMFORT COOLING CERTIFICATE

Manufactured Home Mfg _____
Plant Location _____
Manufactured Home Model _____

The air distribution system of this home has not been designed in anticipation of its use with a central air conditioning system.

(b) For each home designated as suitable for central air conditioning the manufacturer shall provide the maximum central manufactured home air conditioning capacity certified in accordance with the ARI Standard 210/240–89 Unitary Air-Conditioning and Air-Source Heat Pump Equipment and in accordance with § 3280.715(a)(3). If the capacity information provided is based on entrances to the air supply duct at other than the furnace plenum, the manufacturer shall indicate the correct supply air entrance and return air exit locations.

(c) *Comfort cooling information.* For each manufactured home designated, either ''suitable for'' or ''provided with'' a central air conditioning system, the manufacturer shall provide comfort cooling information specific to the manufactured home necessary to complete the cooling load calculations. The comfort cooling information shall include a statement to read as follows:

To determine the required capacity of equipment to cool a home efficiently and economically, a cooling load (heat gain) calculation is required. The cooling load is dependent on the orientation, location and the structure of the home. Central air conditioners operate most efficiently and provide the greatest comfort when their capacity closely approximates the calculated cooling load. Each home's air conditioner should be sized in accordance with chapter 22 of the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals, 1989 Edition, once the location and orientation are known.

INFORMATION PROVIDED BY THE MANUFACTURER NECESSARY TO CALCULATE SENSIBLE HEAT GAIN

Walls (without windows and doors)	U
Ceilings and roofs of light color	U
Ceilings and roofs of dark color	U
Floors	U
Air ducts in floor	U
Air ducts in ceiling	U
Air ducts installed outside the home	U

Information necessary to calculate duct areas.

[40 FR 58752, Dec. 18, 1975. Redesignated at 44 FR 20679, Apr. 6, 1979, as amended at 58 FR 55012, Oct. 25, 1993]

Subpart G—Plumbing Systems

§ 3280.601 Scope.

Subpart G of this standard covers the plumbing materials, fixtures, and equipment installed within or on manufactured homes. It is the intent of this subpart to assure water supply, drain, waste and vent systems which permit satisfactory functioning and provide for health and safety under all conditions of normal use.

§ 3280.602 Definitions.

The following definitions are applicable to subpart G only:

Accessible, when applied to a fixture, connection, appliance or equipment, means having access thereto, but which may require removal of an access panel or opening of a door.

Air gap (water distribution system) means the unobstructed vertical distance through the free atmosphere between the lowest opening from any pipe or faucet supplying water to a tank, plumbing fixture, water supplied appliances, or other device and the flood level rim of the receptacle.

Anti-siphon trap vent device means a device which automatically opens to admit air to a fixture drain above the connection of the trap arm so as to prevent siphonage, and closes tightly when the pressure within the drainage system is equal to or greater than atmospheric pressure so as to prevent the escape of gases from the drainage system into the manufactured home.

Backflow means the flow of water or other liquids, mixtures, or substances into the distributing pipes of a potable supply of water from any source or sources other than its intended sources.

Backflow connection means any arrangement whereby backflow can occur.

Backflow preventer means a device or means to prevent backflow.

Branch means any part of the piping system other than a riser, main or stack.

Common vent means a vent connecting at the junction of fixture drains and serving as a vent for more than one fixture.

Continuous vent means a vertical vent that is a continuation of the drain to which it connects.

Continuous waste means a drain from two or more fixtures connected to a single trap.

Critical level means a point established by the testing laboratory (usually stamped on the device by the manufacturer) which determines the minimum elevation above the flood level rim of the fixture or receptacle served on which the device may be installed. When a backflow prevention device does not bear a critical level marking, the bottom of the vacuum breaker, combination valve, or of any such approved or listed device shall constitute the critical level.

Cross connection means any physical connection or arrangement between two otherwise separate systems or sources, one of which contains potable water and the other either water, steam, gas or chemical of unknown or questionable safety whereby there may be a flow from one system or source to the other, the direction of flow depending on the pressure differential between the two systems.

Developed length means that length of pipe measured along the center line of the pipe and fittings.

Diameter, unless otherwise specifically stated, means the nominal (inside) diameter designated commercially.

Drain means a pipe that carries waste, water, or water-borne waste in a drainage system.

Drain connector means the removable extension, consisting of all pipes, fittings and appurtenances, from the drain outlet to the drain inlet serving the manufactured home.

Drain outlet means the lowest end of the main or secondary drain to which a sewer connection is made.

Drainage system means all piping within or attached to the structure that conveys sewage or other liquid waste to the drain outlet, not including the drain connector.

Fixture drain means the drain from the trap of a fixture to the junction of that drain with any other drain pipe.

Fixture supply means the water supply pipe connecting a fixture to a branch water supply pipe or directly to a main water supply pipe.

Flood-level means the level in the receptacle over which water would overflow to the outside of the receptacle.

Flooded means the condition which results when the liquid in a container or receptacle rises to the flood-level.

Flush tank means that portion of a water closet that is designed to contain sufficient water to adequately flush the fixture.

Flush valve means a device located at the bottom of a flush tank for flushing a water closet.

Flushometer tank: means a device integrated within an air accumulator vessel which is designed to discharge a predetermined quantity of water to fixtures for flushing purposes.

Flushometer valve means a device which discharges a predetermined quantity of water to a fixture for flushing purposes and is closed by direct water pressure.

Grade means the fall (slope) of a pipe in reference to a horizontal plane expressed in inches per foot length.

Horizontal branch means any pipe extending laterally, which receives the discharge from one or more fixture drains and connects to the main drain.

Horizontal pipe means any pipe or fitting which makes an angle of not more than 45 degrees with the horizontal.

Individual vent means a pipe installed to vent a fixture drain.

Inlet coupling means the terminal end of the water system to which the water service connection is attached. It may be a swivel fitting or threaded pipe end.

Main means the principal artery of the system to which branches may be connected.

Main drain means the lowest pipe of a drainage system which receives sewage from all the fixtures within a manufactured home and conducts these wastes to the drain outlet.

Main vent means the principal artery of the venting system to which vent branches may be connected.

Offset means a combination of pipe and/or fittings that brings one section of the pipe out of line but into a line parallel with the other section.

Pitch. See *Grade*.

Plumbing appliance: means any one of a special class of plumbing fixture which is intended to perform a special plumbing function. Its operation and/or control may be dependent upon one or more energized components, such as motors, control, heating elements, or pressure or temperature-sensing elements. Such fixture may operate automatically through one or more of the following actions: A time cycle, a temperature range, a pressure range, a measured volume or weight, or the fixture may be manually adjusted or controlled by the user or operator.

Plumbing appurtenance: means a manufactured device, or a prefabricated assembly, or an on-the-job assembly of component parts, and which is an adjunct to the basic piping system and plumbing system and plumbing fixtures. An appurtenance demands no additional water supply, nor does it add any discharge load to a fixture or the drainage system.

Plumbing fixtures means receptacles, devices, or appliances which are supplied with water or which receive liquid or liquid-borne wastes for discharge into the drainage system.

Plumbing system means the water supply and distribution pipes; plumbing fixtures, faucets and traps; soil, waste and vent pipes; and water-treating or water-using equipment.

Primary vent. See *main vent*.

Relief vent means an auxiliary vent which permits additional circulation of air in or between drainage and vent systems.

Secondary vent means any vent other than the main vent or those serving each toilet.

Sewage means any liquid waste containing animal or vegetable matter in suspension or solution, and may include liquids containing chemicals in solution.

Siphonage means the loss of water seal from fixture traps resulting from partial vacuum in the drainage system which may be of either of the following two types, or a combination of the two:

(a) Self-siphonage resulting from vacuum in a fixture drain generated solely by the discharge of the fixture served by that drain, or,

(b) Induced siphonage resulting from vacuum in the drainage system generated by the discharge of one or more fixtures other than the one under observation.

Trap means a fitting or device designed and constructed to provide a liquid seal that will prevent the back passage of air without materially affecting the flow of liquid waste through it.

Trap arm means the portion of a fixture drain between a trap and its vent.

Trap seal means the vertical depth of liquid that a trap will retain.

Vacuum breaker. See *backflow preventer*.

Vent cap means the device or fitting which protects the vent pipe from foreign substance with an opening to the

atmosphere equal to the area of the vent it serves.

Vent system means that part of a piping installation which provides circulation of air within a drainage system.

Vertical pipe means any pipe or fitting which makes an angle of not more than 45 degrees with the vertical.

Water closet drain means that part of the drainage piping which receives the discharge from each individual water closet.

Water connection means the fitting or point of connection for the manufactured home water distribution system designed for connection to a water supply.

Water connector means the removable extension connecting the manufactured home water distribution system to the water supply.

Water distribution system means potable water piping within or permanently attached to the manufactured home.

Wet vent means a vent which also serves as a drain for one or more fixtures.

Wet vented drainage system means the specially designed system of drain piping that also vents one or more plumbing fixtures by means of a common waste and vent pipe.

Whirlpool bathtub means a plumbing appliance consisting of a bathtub fixture which is equipped and fitted with a circulation piping system, pump, and other appurtenances and is so designed to accept, circulate, and discharge bathtub water upon each use.

[40 FR 58752, Dec. 18, 1975. Redesignated at 44 FR 20679, Apr. 6, 1979, as amended at 52 FR 4584, Feb. 12, 1987; 52 FR 47553, Dec. 15, 1987; 58 FR 55012, Oct. 25, 1993]

§ 3280.603 General requirements.

(a) *Minimum requirements.* Any plumbing system installed in a manufactured home shall conform, at least, with the provisions of this subpart.

(1) *General.* The plumbing system shall be of durable material, free from defective workmanship, and so designed and constructed as to give satisfactory service for a reasonable life expectancy.

(2) *Conservation.* Water closets shall be selected and adjusted to use the minimum quantity of water consistent with proper performance and cleaning.

(3) *Connection to drainage system.* All plumbing, fixtures, drains, appurtenances, and appliances designed or used to receive or discharge liquid waste or sewage shall be connected to the manufactured home drainage system in a manner provided by this standard.

(4) *Workmanship.* All design, construction, and workmanship shall be in conformance with accepted engineering practices and shall be of such character as to secure the results sought to be obtained by this standard.

(5) *Components.* Plumbing materials, devices, fixtures, fittings, equipment, appliances, appurtenance, and accessories intended for use in or attached to a manufactured home shall conform to one of the applicable standards referenced in § 3280.604. Where an applicable standard is not referenced, or an alternative recognized standard is utilized, the plumbing component shall be listed by a nationally recognized testing laboratory, inspection agency or other qualified organization as suitable for the intended use.

(6) *Prohibited fittings and practices.* (i) Drainage or vent piping shall not be drilled and tapped for the purpose of making connections.

(ii) Except as specifically provided elsewhere in this standard, vent pipes shall not be used as waste or drain pipes.

(iii) Fittings, connections, devices, or methods of installation that obstruct or retard the flow of sewage, or air in the drainage or venting systems in an amount greater than the normal frictional resistance to flow shall not be used unless their use is acceptable in this standard or their use is accepted as having a desirable and acceptable function of ultimate benefit to the proper and continued functioning of the plumbing system.

(iv) Cracks, holes, or other imperfections in materials shall not be concealed by welding, brazing, or soldering or by paint, wax, tar, or other leak-sealing or repairing agents.

(v) Piping, fixtures or equipment shall be located so as not to interfere with the normal use or with the normal operation and use of windows, doors or other required facilities.

(vi) Galvanized pipe shall not be bent or welded.

(7) *Alignment of fittings.* All valves, pipes, and fittings shall be installed in correct relationship to the direction of flow.

(b) *Protective requirements.* (1) Cutting structural members. Structural members shall not be unnecessarily or carelessly weakened by cutting or notching.

(2) *Exposed piping.* All piping, pipe threads, hangers, and support exposed to the weather, water, mud, and road hazard, and subject to damage therefrom, shall be painted, coated, wrapped, or otherwise protected from deterioration.

(3) *Road damage.* Pipes, supports, drains, outlets, or drain hoses shall not extend or protrude in a manner where they could be unduly subjected to damage during transit.

(4) *Freezing.* All piping and fixtures subject to freezing temperatures shall be insulated or protected to prevent freezing, under normal occupancy. The manufacturer shall provide:

(i) Written installation instructions for the method(s) required for compliance to this section;

(ii) A statement in his installation instructions that if heat tape is used it shall be listed for use with manufactured homes;

(iii) A receptacle outlet for the use of a heat tape located on the underside of the manufactured home within 2 feet of the water supply inlet. The receptacle outlet provided shall not be placed on a branch circuit which is protected by a ground fault circuit interrupter.

(5) All piping, except the fixture trap, shall be designed to allow drainage.

(6) *Rodent resistance.* All exterior openings around piping and equipment shall be sealed to resist the entrance of rodents.

(7) Piping and electrical wiring shall not pass through the same holes in walls, floors or roofs. Plastic piping shall not be exposed to heat in excess of manufacturers recommendation or radiation from heat producing appliances.

[40 FR 58752, Dec. 18, 1975, as amended at 42 FR 54383, Oct. 5, 1977. Redesignated at 44 FR 20679, Apr. 6, 1979, as amended at 58 FR 55012, Oct. 25, 1993]

§ 3280.604 Materials.

(a) *Minimum standards.* Materials, devices, fixtures, fittings, equipment, appliances, appurtenances and accessories shall conform to one of the standards in the following table and be free from defects. Where an appropriate standard is not indicated in the table or a standard not indicated in the table is preferred, the item may be used if it is listed. A listing is also required when so specified in other sections of this subpart.

(b) Where more than one standard is referenced for a particular material or component, compliance with only one of those standards is acceptable. Exceptions:

(1) When one of the reference standards requires evaluation of chemical, toxicity or odor properties which are not included in the other standard, then conformance to the applicable requirements of each standard shall be demonstrated;

(2) When a plastic material or component is not covered by the Standards in the following table, it must be certified as non-toxic in accordance with ANSI/NSF 61–2001, Drinking water system components—Health effects.

FERROUS PIPE AND FITTINGS

Gray Iron Threaded Fittings—ANSI/ASME B16.4–1992.

Malleable Iron Threaded Fittings—ANSI/ASME B16.3–1992.

Material and Property Standard for Special Cast Iron Fittings—IAPMO PS 5–84.

Welding and Seamless Wrought Steel Pipe—ANSI/ASME B36.10–1979.

Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless—ASTM A53–93.

Pipe Threads, General Purpose (Inch)—ANSI/ASME B1.20.1–1983.

Standard Specification for Cast Iron Soil Pipe and Fittings—ASTM A74–92.

Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications—CISPI–301–90.

NONFERROUS PIPE AND FITTINGS

Standard Specification for Seamless Copper Pipe, Standard Sizes—ASTM B42–93.

Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube—ASTM B251–93.

Standard Specification for Seamless Copper Water Tube—ASTM B88–93.

Standard Specification for Copper Drainage Tube (DWV)—ASTM B306–92.
Wrought Copper and Copper Alloy Solder-Joint Pressure Fitting—ASME/ANSI B16.22–1989.
Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings-DWV—ASME/ANSI B16.29–1986.
Cast Copper Alloy Solder-Joint Pressure Fittings—ANSI B16.18–1984.
Cast Copper Alloy Solder-Joint Drainage Fittings-DWV—ASME B16.23–1992.
Cast Copper Alloy Fittings for Flared Copper Tubes—ASME/ANSI B16.26–1988.
Standard Specification for Seamless Red Brass Pipe, Standard Sizes—ASTM B43–91.
Cast Bronze Threaded Fittings, Classes 125 and 250—ANSI/ASME B16.15–1985.

PLASTIC PIPE AND FITTINGS

Standard Specification Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings—ASTM D2661–91.
Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings—ASTM D2665–91b.
Standard Specification for Drain, Waste, and Vent (DWV) Plastic Fittings Patterns—ASTM D3311–92.
Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40, Plastic Drain, Waste, and Vent Pipe With a Cellular Core—ASTM F628–91.
Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems—ASTM D2846–92.
Standard Specification for Polybutylene (PB) Plastic Hot- and Cold-Water Distribution Systems—ASTM D3309–92a.
Plastic Piping Components and Related Materials—ANSI/NSF 14–1990.

MISCELLANEOUS

Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings—ASTM C564–88.
Backflow Valves—ANSI A112.14.1–1975.
Plumbing Fixture Setting Compound—TTP 1536A–1975.
Material and Property Standard for Cast Brass and Tubing P-Traps—IAPMO PS 2–89.
Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems—ANSI Z21.22–1986, With Addendum Z21.22a-1990.
Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings—ASTM D2235–88.
Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems—ASTM D2564–91a.
Specification for Neoprene Rubber Gaskets for HUB and Spigot Cast Iron Soil Pipe and Fittings—CISPI–HSN–85.
Plumbing System Components for Manufactured Homes and Recreational Vehicles—ANSI/NSF 24–1988.
Material and Property Standard for Diversion Tees and Twin Waste Elbow—IAPMO PS 9–84.
Material and Property Standard for Flexible Metallic Water Connectors—IAPMO PS 14–89.
Material and Property Standard for Dishwasher Drain Airgaps—IAPMO PS 23–89.
Material and Property Standards for Backflow Prevention Assemblies—IAPMO PS 31–91.
Performance Requirements for Air Admittance Valves for Plumbing Drainage Systems, Fixture and Branch Devices—ASSE Standard #1051, 1990 Revised: 1996/ANSI 1998.
Drinking Water System Components–Health Effects—ANSI/NSF 61–2001.

PLUMBING FIXTURES

Plumbing Fixtures (General Specifications)—FS WW–P–541E/GEN–1980.
Vitreous China Plumbing Fixtures—ANSI/ASME A112.19.2(M)–1990.
Enameled Cast Iron Plumbing Fixtures—ANSI/ASME A112.19.1M–1987.
Porcelain Enameled Formed Steel Plumbing Fixtures—ANSI/ASME A112.19.4(M)–1984.
Plastic Bathtub Units with Addenda Z124.1a–1990 and Z124.16–1991—ANSI Z124.1–1987.
Standard for Porcelain Enameled Formed Steel Plumbing Fixtures—IAPMO TSC 22–85.
Plastic Shower Receptors and Shower Stalls with Addendum Z124.2a–1990—ANSI Z124.2–1987.
Stainless Steel Plumbing Fixtures (Designed for Residential Use)—ANSI/ASME A112.19.3M–1987.
Material and Property Standard for Drains for Prefabricated and Precast Showers—IAPMO PS 4–90.
Plastic Lavatories with Addendum Z124.3a–1990—ANSI Z124.3–1986.
Safety Performance Specifications and Methods of Test for Safety Glazing Materials Used in Building—ANSI Z97.1–1984.
Water Heater Relief Valve Drain Tubes—ASME A112.4.1–1993.
Flexible Water Connectors—ASME A112.18.6–1999.
Performance Requirements for Backflow Protection Devices and Systems in Plumbing Fixture Fittings—ASME A112.18.3M–1996.
Non-Vitreous Ceramic Plumbing Fixtures—ASME A112.19.9M–1991.
Dual Flush Devices for Water Closets—ASME A119.19.10–1994.
Deck Mounted Bath/Shower Transfer Valves with Integral Backflow Protection—ASME A112.18.7–1999.

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[58 FR 55013, Oct. 25, 1993, as amended at 70 FR 72048, Nov. 30, 2005]

§ 3280.605 Joints and connections.

(a) *Tightness.* Joints and connections in the plumbing system shall be gastight and watertight for the pressures required under testing procedures.

(1) *Assembling of pipe.* All joints and connections shall be correctly assembled for tightness. Pipe threads shall be fully engaged with the threads of the fitting. Plastic pipe and copper tubing shall be inserted to the full depth of the solder cup or welding sockets of each fitting. Pipe threads and slip joints shall not be wrapped with string, paper, putty, or similar fillers.

(2) *Threaded joints.* Threads for screw pipe and fittings shall conform to the approved or listed standard. Pipe ends shall be reamed out to size of bore. All burrs, chips, cutting oil and foreign matter shall be removed. Pipe joint cement or thread lubricant shall be of approved type and applied to male threads only.

(3) *Solder joints.* Solder joints for tubing shall be made with approved or listed solder type fittings. Surfaces to be soldered shall be cleaned bright. The joints shall be properly fluxed with noncorrosive paste type flux and, for manufactured homes to be connected to a public water system, made with solder having not more than 0.2 percent lead.

(4) *Plastic pipe, fittings and joints.* Plastic pipe and fittings shall be joined by installation methods recommended by the manufacturer or in accordance with the provisions of a recognized, approved, or listed standard.

(5) *Union joints.* Metal unions in water piping shall have metal-to-metal ground seats.

(6) *Flared joints.* Flared joints for soft-copper water tubing shall be made with approved or listed fittings. The tubing shall be expanded with a proper flaring tool.

(7) *Cast iron soil pipe joints.* Approved or listed cast iron pipe may be joined as follows:

(i) Approved or listed hubless pipe as per the manufacturer's recommendation.

(ii) Hub and plain-end soil pipe may be joined by compression fittings per the manufacturer's recommendation.

[40 FR 58752, Dec. 18, 1975. Redesignated at 44 FR 20679, Apr. 6, 1979, as amended at 53 FR 23611, June 23, 1988]

§ 3280.606 Traps and cleanouts.

(a) *Traps*—(1) *Traps required*. Each plumbing fixture, except listed toilets, shall be separately trapped by approved water seal ''P'' traps. All traps shall be effectively vented.

(2) *Dual fixtures*. A two-compartment sink, two single sinks, two lavatories, or a single sink and a single lavatory with waste outlets not more than 30 inches apart and in the same room and flood level rims at the same level may be connected to one ''P'' trap and may be considered as a single fixture for the purpose of drainage and vent requirements.

(3) *Prohibited traps*. A trap which depends for its seal upon concealed interior partitions shall not be used. Full ''S'' traps, bell traps, drum traps, crown-vented traps, and running traps are prohibited. Fixtures shall not be double-trapped.

(4) *Material and design*. Each trap shall be self-cleaning with a smooth and uniform interior waterway. Traps shall be manufactured of cast iron, cast brass, or drawn brass tubing of not less than No. 20 Brown and Sharpe gage, or approved or listed plastic, or other approved or listed material. Union joints for a trap shall be beaded to provide a shoulder for the union nut. Each trap shall have the manufacturer's name stamped or cast in the body of the trap, and each tubing trap shall show the gage of the tubing.

(5) *Trap seal*. Each ''P'' trap shall have a water seal of not less than 2 inches and not more than 4 inches and shall be set true to its seal.

(6) *Size*. Traps shall be not less than 1¼ inches in diameter. A trap shall not be larger than the waste pipe to which it is connected.

(7) *Location*. Each trap shall be located as close to its vent and to its fixture outlet as structural conditions will permit.

(8) *Length of tailpiece*. The vertical distance from a trap to the fixture outlet shall not exceed 24 inches.

(9) *Installation*. (i) *Grade of trap arm*. The piping between a ''P'' trap and the fixture tee or the vented waste line shall be graded ¼ inch per foot towards the vent and in no event shall have a slope greater than its diameter. The vent opening at fixture tees shall not be below the weir of the ''P'' trap outlet.

(ii) *Trap arm offset*. The piping between the ''P'' trap and vent may change direction or be offset horizontally with the equivalent of no more than 180 degrees total change in direction with a maximum of 90 degrees by any one fitting.

(iii) *Concealed traps*. Traps with mechanical joints shall be accessible for repair and inspection.

(iv) *Removability of traps, etc*. Traps shall be designed and installed so the ''U'' bend is removable without removing the strainers from the fixture. Continuous waste and tail pieces which are permanently attached to the ''U'' bend shall also be removable without removing the strainer from the fixture.

(b) *Cleanout openings*—(1) *Location of cleanout fittings*. (i) Cleanouts shall be installed if the drainage system cannot be cleaned through fixtures, drains, or vents. Cleanouts shall also be provided when fittings of more than 45 degrees are used to affect an offset except where long turn ells are used which provide sufficient ''sweep'' for cleaning.

(ii) A full size cleanout shall be installed at the upper end of any section of drain piping which does not have the required minimum slope of ¼ inch per foot grade.

(iii) A cleaning tool shall not be required to pass through more than 360 degrees of fittings, excluding removable ''P'' traps, to reach any part of the drainage system. Water closets may be removed for drainage system access.

(2) *Access to cleanouts*. Cleanouts shall be accessible through an unobstructed minimum clearance of 12 inches directly in front of the opening. Each cleanout fitting shall open in a direction opposite to the flow or at right angles to the pipe. Concealed cleanouts

that are not provided with access covers shall be extended to a point above the floor or outside of the manufactured home, with pipe and fittings installed, as required, for drainage piping without sags and pockets.

(3) *Material*. Plugs and caps shall be brass or approved or listed plastic, with screw pipe threads.

(4) *Design*. Cleanout plugs shall have raised heads except that plugs at floor level shall have counter-sunk slots.

[40 FR 58752, Dec. 18, 1975. Redesignated at 44 FR 20679, Apr. 6, 1979, as amended at 58 FR 55014, Oct. 25, 1993]

§ 3280.607 Plumbing fixtures.

(a) *General requirements*—(1) *Quality of fixtures*. Plumbing fixtures shall have smooth impervious surfaces, be free from defects and concealed fouling surfaces, be capable of resisting road shock and vibration, and shall conform in quality and design to listed standards. Fixtures shall be permanently marked with the manufacturer's name or trademark.

(2) *Strainers*. The waste outlet of all plumbing fixtures, other than toilets, shall be equipped with a drain fitting that will provide an adequate unobstructed waterway.

(3) *Fixture connections*. Fixture tailpieces and continuous wastes in exposed or accessible locations shall be not less than No. 20 Brown and Sharpe gage seamless drawn-brass tubing or other approved pipe or tubing materials. Inaccessible fixture connections shall be constructed according to the requirements for drainage piping. Each fixture tailpiece, continuous waste, or waste and overflow shall be not less than 1½ inches for sinks of two or more compartments, dishwashers, clothes washing machines, laundry tubs, bath tubs, and not less than 1¼ inches for lavatories and single compartment sinks having a 2 inch maximum drain opening.

(4) *Concealed connections*. Concealed slip joint connections shall be provided with adequately sized unobstructed access panels and shall be accessible for inspection and repair.

(5) *Directional fitting*. An approved or listed ''Y'' or other directional-type branch fitting shall be installed in every tailpiece or continuous waste that receives the discharge from food waste disposal units, dishwashing, or other force-discharge fixture or appliance. (See also § 3280.607(b)(4)(ii).)

(6) *Water conservation*. All lavatory faucets, showerheads, and sink faucets must not exceed a flow of 2.5 gallons per minute (gpm).

(b) *Fixtures*—(1) *Spacing*. All plumbing fixtures shall be so installed with regard to spacing as to be reasonably accessible for their intended use.

(2) *Water closets*. (i) Water closets shall be designed and manufactured according to approved or listed standards and shall be equipped with a water flushing device capable of adequately flushing and cleaning the bowl at each operation of the flushing mechanism.

(ii) Water closet flushing devices shall be designed to replace the water seal in the bowl after each operation. Flush valves, flushometer valves, flushometer tanks and ballcocks shall operate automatically to shut off at the end of each flush or when the tank is filled to operating capacity.

(iii) All water closets must be low consumption (1.6 gallons per flush (gpf)) closets.

(iv) Flush tanks shall be fitted with an overflow pipe large enough to prevent flooding at the maximum flow rate of the ball cock. Overflow pipes shall discharge into the toilet, through the tank.

(v) Water closets that have fouling surfaces that are not thoroughly washed at each discharge shall be prohibited. Any water closet that might permit the contents of the bowl to be siphoned back into the water system shall be prohibited.

(vi) *Floor connection*. Water closets shall be securely bolted to an approved flange or other approved fitting which is secured to the floor by means of corrosion-resistant screws. The bolts shall be of solid brass or other corrosion-resistant material and shall be not less than one-fourth inch in diameter. A watertight seal shall be made between the water closet and flange or other approved fitting by use of a gasket or sealing compound.

(3) *Shower compartment*. (i) Each compartment stall shall be provided with an approved watertight receptor with sides and back extending at least 1 inch

above the finished dam or threshold. In no case shall the depth of a shower receptor be less than 2 inches or more than 9 inches measured from the top of the finished dam or threshold to the top of the drain. The wall area shall be constructed of smooth, noncorrosive, and nonabsorbent waterproof materials to a height not less than 6 feet above the bathroom floor level. Such walls shall form a watertight joint with each other and with the bathtub, receptor or shower floor. The floor of the compartment shall slope uniformly to the drain at not less than one-fourth nor more than one-half inch per foot.

(ii) The joint around the drain connection shall be made watertight by a flange, clamping ring, or other approved listed means.

(iii) Shower doors and tub and shower enclosures shall be constructed so as to be waterproof and, if glazed, glazing shall comply with the standard for Safety Performance Specifications and Methods of Test for Safety Glazing Materials Used in Buildings, ANSI Z97.1–1984.

(iv) Prefabricated plumbing fixtures shall be approved or listed.

(4) *Dishwashing machines.* (i) A dishwashing machine shall not be directly connected to any waste piping, but shall discharge its waste through a fixed air gap installed above the machine, or through a high loop as specified by the dishwashing machine manufacturer, or into an open standpipe-receptor with a height greater than the washing compartment of the machine. When a standpipe is used, it shall be at least 18 inches but not more than 30 inches above the trap weir. The drain connections from the air gap or high loop may connect to an individual trap, to a directional fitting installed in the sink tailpiece or to an opening provided on the inlet side of a food waste disposal unit.

(ii) Drain from a dishwashing machine shall not be connected to a sink tailpiece, continuous waste line, or trap on the discharge side of a food waste disposal unit.

(5) *Clothes washing machines.* (i) Clothes washing machines shall drain either into a properly vented trap, into a laundry tub tailpiece with watertight connections, into an open standpipe receptor, or over the rim of a laundry tub.

(ii) Standpipes shall be 1½ inches minimum nominal iron pipe size, 1½ inches diameter nominal brass tubing not less than No. 20 Brown and Sharpe gage, or 1½ inches approved plastic materials. Receptors shall discharge into a vented trap or shall be connected to a laundry tub tailpiece by means of an approved or listed directional fitting. Each standpipe shall extend not less than 18 inches or more than 30 inches above its trap and shall terminate in an accessible location no lower than the top of clothes washing machine. A removable tight fitting cap or plug shall be installed on the standpipe when clothes washer is not provided.

(iii) Clothes washing machine drain shall not be connected to the tailpiece, continuous waste, or trap of any sink or dishwashing machine.

(c) *Installation*—(1) *Access.* Each plumbing fixture and standpipe receptor shall be located and installed in a manner to be accessible for usage, cleaning, repair and replacement. Access to diverter valves and other connections from the fixture hardware is not required.

(2) *Alignment.* Fixtures shall be set level and in true alignment with adjacent walls. Where practical, piping from fixtures shall extend to nearest wall.

(3) *Brackets.* Wall-hung fixtures shall be rigidly attached to walls by metal brackets or supports without any strain being transmitted to the piping connections. Flush tanks shall be securely fastened to toilets or to the wall with corrosive-resistant materials.

(4) *Tub supports.* Bathtub rims at wall shall be supported on metal hangers or on end-grain wood blocking attached to the wall unless otherwise recommended by the manufacturer of the tub.

(5) *Fixture fittings.* Faucets and diverters shall be installed so that the flow of hot water from the fittings corresponds to the left-hand side of the fitting.

(6) *Whirlpool bathtub appliances*—(i) *Access panel.* A door or panel of sufficient size shall be installed to provide access to the pump for repair and/or replacement.

(ii) *Piping drainage.* The circulation pump shall be accessibly located above the crown weir of the trap. The pump drain line shall be properly sloped to drain the volute after fixture use.

(iii) *Piping.* Whirlpool bathtub circulation piping shall be installed to be self-draining.

(iv) *Electrical.* Wiring must comply with Articles 680.70, 680.71, and 680.72 of the National Electrical Code, NFPA No. 70–2005.

[40 FR 58752, Dec. 18, 1975, as amended at 42 FR 961, Jan. 4, 1977. Redesignated at 44 FR 20679, Apr. 6, 1979, as amended at 52 FR 4586, Feb. 12, 1987; 58 FR 55014, Oct. 25, 1993; 70 FR 72049, Nov. 30, 2005; 71 FR 19639, Apr. 17, 2006]

§ 3280.608 Hangers and supports.

(a) *Strains and stresses.* Piping in a plumbing system shall be installed without undue strains and stresses, and provision shall be made for expansion, contraction, and structural settlement.

(b) *Piping supports.* Piping shall be secured at sufficiently close intervals to keep the pipe in alignment and carry the weight of the pipe and contents. Unless otherwise stated in the standards for specific materials shown in the table in § 3280.604(a), or unless specified by the pipe manufacturer, plastic drainage piping shall be supported at intervals not to exceed 4 feet and plastic water piping shall be supported at intervals not to exceed 3 feet.

(c) *Hangers and anchors.* (1) Hangers and anchors shall be of sufficient strength to support their proportional share of the pipe alignments and prevent rattling.

(2) Piping shall be securely attached to the structure by hangers, clamps, or brackets which provide protection against motion, vibration, road shock, or torque in the chassis.

(3) Hangers and straps supporting plastic pipe shall not compress, distort, cut or abrade the piping and shall allow free movement of the pipe.

§ 3280.609 Water distribution systems.

(a) *Water supply*—(1) *Supply piping.* Piping systems shall be sized to provide an adequate quantity of water to each plumbing fixture at a flow rate sufficient to keep the fixture in a clean and sanitary condition without any danger of backflow or siphonage. (See table in § 3280.609(f)(1)). The manufacturer shall include in his written installation instructions that the manufactured home has been designed for an inlet water pressure of 80 psi, and a statement that when the manufactured home is to be installed in areas where the water pressure exceeds 80 psi, a pressure reducing valve should be installed.

(2) *Hot water supply.* Each manufactured home equipped with a kitchen sink, and bathtub and/or shower shall be provided with a hot water supply system including a listed water heater.

(b) *Water outlets and supply connections*—(1) *Water connection.* Each manufactured home with a water distribution system shall be equipped with a ¾ inch threaded inlet connection. This connection shall be tagged or marked ''Fresh Water Connection'' (or marked ''Fresh Water Fill''). A matching cap or plug shall be provided to seal the water inlet when it is not in use, and shall be permanently attached to the manufactured home or water supply piping. When a master cold water shutoff full flow valve is not installed on the main feeder line in an accessible location, the manufacturer's installation instructions shall indicate that such a valve is to be installed in the water supply line adjacent to the home. When a manufactured home includes expandable rooms or is composed of two or more units, fittings or connectors designed for such purpose shall be provided to connect any water piping. When not connected, the water piping shall be protected by means of matching threaded caps or plugs.

(2) *Prohibited connections.* (i) The installation of potable water supply piping or fixture or appliance connections shall be made in a manner to preclude the possibility of backflow.

(ii) No part of the water system shall be connected to any drainage or vent piping.

(3) *Rim outlets.* The outlets of faucets, spouts, and similar devices shall be spaced at least 1 inch above the flood level of the fixture.

(4) *Appliance connections.* Water supplies connected to clothes washing or dishwashing machines shall be protected by an approved or listed fixed

air gap provided within the appliance by the manufacturer.

(5) *Flushometer valves or manually operated flush valves.* An approved or listed vacuum breaker shall be installed and maintained in the water supply line on the discharge side of a water closet flushometer valve or manually operated flush valve. Vacuum breakers shall have a minimum clearance of 6 inches above the flood level of the fixture to the critical level mark unless otherwise permitted in their approval.

(6) *Flush tanks.* Water closet flush tanks shall be equipped with an approved or listed anti-siphon ball cock which shall be installed and maintained with its outlet or critical level mark not less than 1 inch above the full opening of the overflow pipe.

(7) *Hose bibbs.* When provided, all exterior hose bibbs and laundry sink hose connections shall be protected by a listed non-removable backflow prevention device. This is not applicable to hose connections provided for automatic washing machines with built-in backflow prevention.

(8) *Flushometer tanks.* Flushometer tanks shall be equipped with an approved air gap on the vacuum breaker assembly located above the flood level rim above the fixture.

(c) *Water heater safety devices*—(1) *Relief valves.* (i) All water heaters shall be installed with approved and listed fully automatic valve or valves designed to provide temperature and pressure relief.

(ii) Any temperature relief valve or combined pressure and temperature relief valve installed for this purpose shall have the temperature sensing element immersed in the hottest water within the upper 6 inches of the tank. It shall be set to start relieving at a pressure of 150 psi or the rated working pressure of the tank whichever is lower and at or below a water temperature of 210 °F.

(iii) Relief valves shall be provided with full-sized drains, with cross sectional areas equivalent to that of the relief valve outlet, which shall be directed downward and discharge beneath the manufactured home. Drain lines shall be of a material listed for hot water distribution and shall drain fully by gravity, shall not be trapped, and shall not have their outlets threaded, and the end of the drain shall be visible for inspection.

(d) *Materials*—(1) *Piping material.* Water pipe shall be of standard weight brass, galvanized wrought iron, galvanized steel, Type K, L or M copper tubing, approved or listed plastic or other approved or listed material.

(i) *Plastic piping.* All plastic water piping and fittings in manufactured homes must be listed for use with hot water.

(ii) [Reserved]

(2) *Fittings.* Appropriate fittings shall be used for all changes in size and where pipes are joined. The material and design of fittings shall conform to the type of piping used. Special consideration shall be given to prevent corrosion when dissimilar metals are joined.

(i) Fittings for screw piping shall be standard weight galvanized iron for galvanized iron and steel pipe, and of brass for brass piping. They shall be installed where required for change in direction, reduction of size, or where pipes are joined together.

(ii) Fittings for copper tubing shall be cast brass or drawn copper (sweat-soldered) or shall be approved or listed fittings for the purpose intended.

(3) *Prohibited material.* Used piping materials shall not be permitted. Those pipe dopes, solder, fluxes, oils, solvents, chemicals, or other substances that are toxic, corrosive, or otherwise detrimental to the water system shall not be used. In addition, for those manufactured homes to be connected to a public water system, all water piping shall be lead-free (as defined in section 109(c)(2) of the Safe Drinking Water Act Amendments of 1986) with solders and flux containing not more than 0.2 percent lead and pipes and pipe fittings containing not more than 8.0 percent lead.

(e) *Installation of piping*—(1) *Minimum requirement.* All piping equipment, appurtenances, and devices shall be installed in workmanlike manner and shall conform with the provisions and intent of this standard.

(2) *Screw pipe.* Iron pipe-size brass or galvanized iron or steel pipe fittings shall be joined with approved or listed standard pipe threads fully engaged in the fittings. Pipe ends shall be reamed

to the full bore of the pipe. Pipe-joint compound shall be insoluble in water, shall be nontoxic and shall be applied to male threads only.

(3) *Solder fittings*. Joints in copper water tubes shall be made by the appropriate use of approved cast brass or wrought copper fittings, properly soldered together. The surface to be soldered shall be thoroughly cleaned bright mechanically. The joints shall be properly fluxed and made with a solder that contains no more than 0.2 percent lead.

(4) *Flared fittings*. A flaring tool shall be used to shape the ends of flared tubing to match the flare of fittings.

(5) *Plastic pipe and fittings*. Plastic pipe and fittings shall be joined by installation methods recommended by the manufacturer or in accordance with provisions of a listed standard.

(f) *Size of water supply piping*—(1) *Minimum size*. The size of water supply piping and branch lines shall not be less than sizes shown in the following table:

MINIMUM SIZE TUBING AND PIPE FOR WATER DISTRIBUTION SYSTEMS

Number of fixtures	Tubing (nominal)		Pipe iron pipe size (inches)
	Diameter (inches)	Outer diameter (inches)	
1	*1/4	3/8	1/2
2	3/8	1/2	1/2
3	1/2	5/8	1/2
4	1/2	5/8	1/2
5 or more	3/4	7/8	3/4

*6 ft maximum length.

Exceptions to table: 3/8 inch nominal diameter or 1/2 inch OD minimum size for clothes washing or dishwashing machines, unless larger size is recommended by the fixture manufacturer. 1/2 inch nominal diameter or 5/8 inch OD minimum size for flushometer or metering type valves unless otherwise specified in their listing. No galvanized screw piping shall be less than 1/2 inch iron pipe size.

(2) *Sizing procedure*. Both hot and cold water piping systems shall be computed by the following method:

(i) *Size of branch*. Start at the most remote outlet on any branch of the hot or cold water piping and progressively count towards the water service connection, computing the total number of fixtures supplied along each section of piping. Where branches are joined together, the number of fixtures on each branch shall be totalled so that no fixture is counted twice. Following down the left-hand column of the preceding table a corresponding number of fixtures will be found. The required pipe or tubing size is indicated in the other columns on the same line.

(ii) A water heater, food waste disposal unit, evaporative cooler or ice maker shall not be counted as a water-using fixture when computing pipe sizes.

(g) *Line valves*. Valves, when installed in the water supply distribution system (except those immediately controlling one fixture supply) and when fully opened, shall have a cross-sectional area of the smallest orifice or opening, through which the water flows, at least equal to the cross-sectional area of the nominal size of the pipe in which the valve is installed.

[40 FR 58752, Dec. 18, 1975. Redesignated at 44 FR 20679, Apr. 6, 1979, as amended at 52 FR 4586, Feb. 12, 1987; 53 FR 23611, June 23, 1988; 58 FR 55014, Oct. 25, 1993]

§ 3280.610 Drainage systems.

(a) *General*. (1) Each fixture directly connected to the drainage system shall be installed with a water seal trap (§ 3280.606(a)).

(2) The drainage system shall be designed to provide an adequate circulation of air in all piping with no danger of siphonage, aspiration, or forcing of trap seals under conditions of ordinary use.

(b) *Materials*—(1) *Pipe*. Drainage piping shall be standard weight steel, wrought iron, brass, copper tube DWV, listed plastic, cast iron, or other listed or approved materials.

(2) *Fittings*. Drainage fittings shall be recessed drainage pattern with smooth interior waterways of the same diameter as the piping and shall be of a material conforming to the type of piping used. Drainage fittings shall be designed to provide for a 1/4 inch per foot grade in horizontal piping.

(i) Fittings for screw pipe shall be cast iron, malleable iron, brass, or listed plastic with standard pipe threads.

(ii) Fittings for copper tubing shall be cast brass or wrought copper.

(iii) Socket-type fittings for plastic piping shall comply with listed standards.

(iv) Brass or bronze adaptor or wrought copper fittings shall be used to join copper tubing to threaded pipe.

(c) *Drain outlets.* (1) Each manufactured home shall have only one drain outlet.

(2) *Clearance from drain outlet.* The drain outlet shall be provided with a minimum clearance of 3 inches in any direction from all parts of the structure or appurtenances and with not less than 18 inches unrestricted clearance directly in front of the drain outlet.

(3) *Drain connector.* The drain connector shall not be smaller than the piping to which it is connected and shall be equipped with a water-tight cap or plug matching the drain outlet. The cap or plug shall be permanently attached to the manufactured home or drain outlet.

(4) The drain outlet and drain connector shall not be less than 3 inches inside diameter.

(5) *Preassembly of drain lines.* Section(s) of the drain system, designed to be located underneath the home, are not required to be factory installed when the manufacturer designs the system for site assembly and also provides all materials and components, including piping, fittings, cement, supports, and instructions necessary for proper site installation.

(d) *Fixture connections.* Drainage piping shall be provided with approved or listed inlet fittings for fixture connections, correctly located according to the size and type of fixture to be connected.

(1) *Water closet connection.* The drain connection for each water closet shall be 3 inches minimum inside diameter and shall be fitted with an iron, brass, or listed plastic floor flange adaptor ring securely screwed, soldered or otherwise permanently attached to the drain piping, in an approved manner and securely fastened to the floor.

(2) [Reserved]

(e) *Size of drainage piping*—(1) *Fixture load.* Except as provided by § 3280.611(d), drain pipe sizes shall be determined by the type of fixture and the total number connected to each drain.

(i) A 1½ inch minimum diameter piping shall be required for one and not more than three individually vented fixtures.

(ii) A 2-inch minimum diameter piping shall be required for four or more fixtures individually vented.

(iii) A 3-inch minimum diameter piping shall be required for water closets.

(f) *Wet-vented drainage system.* Plumbing fixture traps may connect into a wet-vented drainage system which shall be designed and installed to accommodate the passage of air and waste in the same pipe.

(1) *Horizontal piping.* All parts of a wet-vented drainage system, including the connected fixture drains, shall be horizontal except for wet-vented vertical risers which shall terminate with a 1½ inch minimum diameter continuous vent. Where required by structural design, wet-vented drain piping may be offset vertically when other vented fixture drains or relief vents are connected to the drain piping at or below the vertical offsets.

(2) *Size.* A wet-vented drain pipe shall be 2 inches minimum diameter and at least one pipe size larger than the largest connected trap or fixture drain. Not more than three fixtures may connect to a 2-inch diameter wet-vented drain system.

(3) *Length of trap arm.* Fixture traps shall be located within the distance given in § 3280.611(c)(5). Not more than one trap shall connect to a trap arm.

(g) *Offsets and branch fittings*—(1) *Changes in direction.* Changes in direction of drainage piping shall be made by the appropriate use of approved or listed fittings, and shall be of the following angles: 11¼, 22½, 45, 60, or 90 degrees; or other approved or listed fittings or combinations of fittings with equivalent radius or sweep.

(2) *Horizontal to vertical.* Horizontal drainage lines, connecting with a vertical pipe shall enter through 45-degree ''Y'' branches, 60-degree ''Y'' branches, long-turn ''TY'' branches, sanitary ''T'' branches, or other approved or listed fittings or combination of fittings having equivalent sweep. Fittings having more than one branch at the same level shall not be used, unless the fitting is constructed so that

the discharge from any one branch cannot readily enter any other branch. However, a double sanitary ''T'' may be used when the drain line is increased not less than two pipe sizes.

(3) *Horizontal to horizontal and vertical to horizontal.* Horizontal drainage lines connecting with other horizontal drainage lines or vertical drainage lines connected with horizontal drainage lines shall enter through 45-degree ''Y'' branches, long-turn ''TY'' branches, or other approved or listed fittings or combination of fittings having equivalent sweep.

(h) *Grade of horizontal drainage piping.* Except for fixture connections on the inlet side of the trap, horizontal drainage piping shall be run in practical alignment and have a uniform grade of not less than ¼ inch per foot toward the manufactured home drain outlet. Where it is impractical, due to the structural features or arrangement of any manufactured home, to obtain a grade of ¼ inch per foot, the pipe or piping may have a grade of not less than ⅛ inch per foot, when a full size cleanout is installed at the upper end.

[40 FR 58752, Dec. 18, 1975. Redesignated at 44 FR 20679, Apr. 6, 1979, as amended at 52 FR 4586, Feb. 12, 1987; 58 FR 55015, Oct. 25, 1993]

§ 3280.611 Vents and venting.

(a) *General.* Each plumbing fixture trap shall be protected against siphonage and back pressure, and air circulation shall be ensured throughout all parts of the drainage system by means of vents installed in accordance with the requirements of this section and as otherwise required by this standard.

(b) *Materials*—(1) *Pipe.* Vent piping shall be standard weight steel, wrought iron, brass, copper tube DWV, listed plastic, cast iron or other approved or listed materials.

(2) *Fittings.* Appropriate fittings shall be used for all changes in direction or size and where pipes are joined. The material and design of vent fittings shall conform to the type of piping used.

(i) Fittings for screw pipe shall be cast iron, malleable iron, plastic, or brass, with standard pipe threads.

(ii) Fittings for copper tubing shall be cast brass or wrought copper.

(iii) Fittings for plastic piping shall be made to approved applicable standards.

(iv) Brass adaptor fittings or wrought copper shall be used to join copper tubing to threaded pipe.

(v) Listed rectangular tubing may be used for vent piping only providing it has an open cross section at least equal to the circular vent pipe required. Listed transition fittings shall be used.

(c) *Size of vent piping*—(1) *Main vent.* The drain piping for each toilet shall be vented by a 1½ inch minimum diameter vent or rectangular vent of venting cross section equivalent to or greater than the venting cross section of a 1½ inch diameter vent, connected to the toilet drain by one of the following methods:

(i) A 1½ inch diameter (min.) individual vent pipe or equivalent directly connected to the toilet drain within the distance allowed in § 3280.611(c)(5), for 3-inch trap arms undiminished in size through the roof,

(ii) A 1½ inch diameter (min.) continuous vent or equivalent, indirectly connected to the toilet drain piping within the distance allowed in § 3280.611(c)(5) for 3 inch trap arms through a 2-inch wet vented drain that carries the waste of not more than one fixture, or,

(iii) Two or more vented drains when at least one is wet-vented, or 2-inch diameter (minimum), and each drain is separately connected to the toilet drain. At least one of the drains shall connect within the distance allowed in § 3280.611(c)(5) for 3-inch trap arms.

(2) *Vent pipe areas.* Each individually vented fixture with a 1½ inch or smaller trap shall be provided with a vent pipe equivalent in area to a 1¼ inch nominal pipe size. The main vent, toilet vent and relief vent, and the continuous vent of wet-vented systems shall have an area equivalent to 1½ inch nominal pipe size.

(3) *Common vent.* When two fixture traps located within the distance allowed from their vent have their trap arms connected separately at the same level into an approved double fitting, an individual vent pipe may serve as a common vent without any increase in size.

(4) *Intersecting vents.* Where two or more vent pipes are joined together, no

increase in size shall be required; however, the largest vent pipe shall extend full size through the roof.

(5) Distance of fixture trap from vent shall not exceed the values given in the following table:

MAXIMUM DISTANCE OF FIXTURES FROM VENT TRAP

Size of fixture drain (inches)	Distance trap to vent
1¼	4 ft. 6 in.
1½	4 ft 6 in.
2	5 ft.
3	6 ft.

(d) *Anti-siphon trap vent.* An anti-siphon trap vent may be used as a secondary vent system for plumbing fixtures protected by traps not larger than 1½ inches, when installed in accordance with the manufacturers' recommendations and the following conditions:

(1) Not more than two fixtures individually protected by the device shall be drained by a common 1½ inch drain.

(2) Minimum drain size for three or more fixtures individually protected by the device shall be 2 inches.

(3) A primary vent stack must be installed to vent the toilet drain at the point of heaviest drainage fixture unit loading.

(4) The device shall be installed in a location that permits a free flow of air and shall be accessible for inspection, maintenance, and replacement and the sealing function shall be at least 6 inches above the top of the trap arm.

(5) Materials for the anti-siphon trap vent shall be as follows:

(i) Cap and housing shall be listed acrylonitrile-butadiene-styrene, DWV grade;

(ii) Stem shall be DWV grade nylon or acetal;

(iii) Spring shall be stainless steel wire, type 302;

(iv) Sealing disc shall be neoprene, conforming to CISPI-HSN-85, the Specification for Neoprene Rubber Gaskets for HUB and Spigot Cast Iron Soil Pipe and Fittings, and ASTM C 564–88, Standard Specification for Rubber Gaskets for Case Iron Soil Pipe and Fittings, or, Silicone Rubber, Low and High Temperature and Tear Resistant, Conforming to Rubber, Silicone, FS ZZ-R-765B-1970, With 1971 Amendment 1; and Liners, Case, and Sheet, Overwrap; Water-Vapor Proof or Waterproof, Flexible, MIL-L-10547E-1975.

(e) *Grade and connections*—(1) *Horizontal vents.* Each vent shall extend vertically from its fixture ''T'' or point of connection with the waste piping to a point not less than 6 inches above the extreme flood level of the fixture it is venting before offsetting horizontally or being connected with any other vent pipe. Vents for horizontal drains shall connect above the centerline of the drain piping ahead (downstream) of the trap. Where required by structural conditions, vent piping may offset below the rim of the fixture at the maximum angle or height possible.

(f) *Vent terminal*—(1) *Roof extension.* Each vent pipe shall extend through its flashing and terminate vertically, undiminished in size, not less than 2 inches above the roof. Vent openings shall not be less than 3 feet away from any motor-driven air intake that opens into habitable areas.

(2) *Flashing.* The opening around each vent pipe shall be made watertight by an adequate flashing or flashing material.

(g) *Vent caps.* Vent caps, if provided, shall be of the removable type (without removing the flashing from the roof). When vent caps are used for roof space ventilation and the caps are identical to vent caps used for the plumbing system, plumbing system caps shall be identified with permanent markings.

[40 FR 58752, Dec. 18, 1975, as amended at 42 FR 961, Jan. 4, 1977. Redesignated at 44 FR 20679, Apr. 6, 1979, as amended at 58 FR 55015, Oct. 25, 1993]

§ 3280.612 Tests and inspection.

(a) *Water system.* All water piping in the water distribution system shall be subjected to a pressure test. The test shall be made by subjecting the system to air or water at 100 psi for 15 minutes without loss of pressure.

(b) *Drainage and vent system and plumbing fixtures.* The waste and vent system shall be tested by one of the three following alternate methods for evidence or indication of leakage:

(1) *Water test.* Before plumbing fixtures are connected, all of the openings into the piping shall be plugged and the entire piping system subjected to a

static water test for 15 minutes by filling it with water to the top of the highest vent opening. There shall be no evidence of leakage.

(2) *Air test*. After all fixtures have been installed, the traps filled with water, and the remaining openings securely plugged, the entire system shall be subjected to a 2-inch (manometer) water column air pressure test. If the system loses pressure, leaks may be located with smoke pumped into the system, or with soap suds spread on the exterior of the piping (Bubble test).

(3) *Flood level test*. The manufactured home shall be in a level position, all fixtures shall be connected, and the entire system shall be filled with water to the rim of the water closet bowl. (Tub and shower drains shall be plugged). After all trapped air has been released, the test shall be sustained for not less than 15 minutes without evidence of leaks. Then the system shall be unplugged and emptied. The waste piping above the level of the water closet bowl shall then be tested and show no indication of leakage when the high fixtures are filled with water and emptied simultaneously to obtain the maximum possible flow in the drain piping.

(c) *Fixture test*. The plumbing fixtures and connections shall be subjected to a flow test by filling them with water and checking for leaks and retarded flow while they are being emptied.

(d) *Shower compartments*. Shower compartments and receptors shall be tested for leaks prior to being covered by finish material. Each pan shall be filled with water to the top of the dam for not less than 15 minutes without evidence of leakage.

[40 FR 58752, Dec. 18, 1975, as amended at 42 FR 961, Jan. 4, 1977; 42 FR 54383, Oct. 5, 1977. Redesignated at 44 FR 20679, Apr. 6, 1979, as amended at 58 FR 55015, Oct. 25, 1993]

Subpart H—Heating, Cooling and Fuel Burning Systems

§ 3280.701 Scope.

Subpart H of this standard covers the heating, cooling and fuel burning equipment installed within, on, or external to a manufactured home.

§ 3280.702 Definitions.

The definitions in this subpart apply to subpart H only.

Accessible, when applied to a fixture, connection, appliance or equipment, means having access thereto, but which may require the removal of an access panel, door or similar obstruction.

Air conditioner blower coil system means a comfort cooling appliance where the condenser section is placed external to the manufactured home and evaporator section with circulating blower attached to the manufactured home air supply duct system. Provision must be made for a return air system to the evaporator/blower section. Refrigerant connection between the two parts of the system is accomplished by tubing.

Air conditioner split system means a comfort cooling appliance where the condenser section is placed external to the manufactured home and the evaporator section incorporated into the heating appliance or with a separate blower/coil section within the manufactured home. Refrigerant connection between the two parts of the system is accomplished by tubing.

Air conditioning condenser section means that portion of a refrigerated air cooling or (in the case of a heat pump) heating system which includes the refrigerant pump (compressor) and the external heat exchanger.

Air conditioning evaporator section means a heat exchanger used to cool or (in the case of a heat pump) heat air for use in comfort cooling (or heating) the living space.

Air conditioning self contained system means a comfort cooling appliance combining the condenser section, evaporator and air circulating blower into one unit with connecting ducts for the supply and return air systems.

Air duct means conduits or passageways for conveying air to or from heating, cooling, air conditioning or ventilation equipment, but not including the plenum.

Automatic pump (oil lifter) means a pump, not an integral part of the oil-burning appliance, that automatically pumps oil from the supply tank and delivers the oil under a constant head to an oil-burning appliance.

Btu. British thermal units means the quantity of heat required to raise the temperature of one pound of water one degree Fahrenheit.

Btuh means British thermal units per hour.

Burner means a device for the final conveyance of fuel or a mixture of fuel and air to the combustion zone.

Central air conditioning system means either an air conditioning split system or an external combination heating/cooling system.

Class 0 air ducts means ducts of materials and connectors having a fire-hazard classification of zero.

Class 1 air ducts means ducts of materials and connectors having a flame-spread rating of not over 25 without evidence of continued progressive combustion and a smoke-developed rating of not over 50.

Class 2 air ducts means ducts of materials and connectors having a flame-spread rating of not over 50 without evidence of continued progressive combustion and a smoke-developed rating of not over 50 for the inside surface and not over 100 for the outside surface.

Clearance means the distance between the appliance, chimney, vent, chimney or vent connector or plenum and the nearest surface.

Connector-Gas appliance: means a flexible or semi-rigid connector used to convey fuel gas between a gas outlet and a gas appliance.

Energy Efficiency Ratio (EER) means the ratio of the cooling capacity output of an air conditioner for each unit of power input.

EER=Capacity (Btuh)/Power input (watts)

External combination heating/cooling system means a comfort conditioning system placed external to the manufactured home with connecting ducts to the manufactured home for the supply and return air systems.

Factory-built fireplace means a hearth, fire chamber and chimney assembly composed of listed factory-built components assembled in accordance with the terms of listing to form a complete fireplace.

Fireplace stove means a chimney connected solid fuel-burning stove having part of its fire chamber open to the room.

Fuel gas piping system means the arrangement of piping, tubing, fittings, connectors, valves and devices designed and intended to supply or control the flow of fuel gas to the appliance(s).

Fuel oil piping system means the arrangement of piping, tubing, fittings, connectors, valves and devices designed and intended to supply or control the flow of fuel oil to the appliance(s).

Gas clothes dryer means a device used to dry wet laundry by means of heat derived from the combustion of fuel gases.

Gas refrigerator means a gas-burning appliance which is designed to extract heat from a suitable chamber.

Gas supply connection means the terminal end or connection to which a gas supply connector is attached.

Gas supply connector, manufactured home means a listed flexible connector designed for connecting the manufactured home to the gas supply source.

Gas vents means factory-built vent piping and vent fittings listed by an approved testing agency, that are assembled and used in accordance with the terms of their listings, for conveying flue gases to the outside atmosphere.

(1) *Type B gas vent* means a gas vent for venting gas appliances with draft hoods and other gas appliances listed for use with Type B gas vents.

(2) *Type BW gas vent* means a gas vent for venting listed gas-fired vented wall furnaces.

Heat producing appliance means all heating and cooking appliances and fuel burning appliances.

Heating appliance means an appliance for comfort heating or for domestic water heating.

Liquefied petroleum gases. The terms *Liquefied petroleum gases, LPG* and *LP-Gas* as used in this standard shall mean and include any material which is composed predominantly of any of the following hydrocarbons, or mixtures of them: propane, propylene butanes (normal butane or isobutane), and butylenes.

Plenum means an air compartment which is part of an air-distributing system, to which one or more ducts or outlets are connected.

(1) Furnace supply plenum is a plenum attached directly to, or an integral part of, the air supply outlet of the furnace.

(2) Furnace return plenum is a plenum attached directly to, or an integral part of, the return inlet of the furnace.

Quick-disconnect device means a hand-operated device which provides a means for connecting and disconnecting a gas supply or connecting gas systems and which is equipped with an automatic means to shut off the gas supply when the device is disconnected.

Readily accessible means direct access without the necessity of removing any panel, door, or similar obstruction.

Roof jack means that portion of a manufactured home heater flue or vent assembly, including the cap, insulating means, flashing, and ceiling plate, located in and above the roof of a manufactured home.

Sealed combustion system appliance means an appliance which by its inherent design is constructed so that all air supplied for combustion, the combustion system of the appliance, and all products of combustion are completely isolated from the atmosphere of the space in which it is installed.

Water heater means an appliance for heating water for domestic purposes other than for space heating.

[40 FR 58752, Dec. 18, 1975. Redesignated at 44 FR 20679, Apr. 6, 1979, as amended at 52 FR 4586, Feb. 12, 1987; 58 FR 55015, Oct. 25, 1993]

§ 3280.703 Minimum standards.

Heating, cooling and fuel burning appliances and systems in manufactured homes shall be free of defects, and shall conform to applicable standards in the following table unless otherwise specified in this standard. (See § 3280.4) When more than one standard is referenced, compliance with any one such standard shall meet the requirements of this standard.

APPLIANCES

Heating and Cooling Equipment, Second Edition, with 1999 revisions—UL 1995, 1995.

Liquid Fuel-Burning Heating Appliances for Manufactured Homes and Recreational Vehicles, Seventh Edition, with 1997 revisions—UL 307A–1995.

Fixed and Location-Dedicated Electric Room Heaters, Second Edition, with 1998 revisions—UL 2021–1997.

Electric Baseboard Heating Equipment, Fourth Edition, with 1998 revisions—UL 1042–1994.

Electric Central Air Heating Equipment—UL 1096-Fourth Edition-1986 with revisions July 16, 1986, and January 30, 1988.

Gas Burning Heating Appliances for Manufactured Homes and Recreational Vehicles, Fourth Edition, with 1998 revisions—UL 307B–1995.

Gas Clothes Dryers Volume 1, Type 1 Clothes Dryers—ANSI Z21.5.1–/CSA 7.1–M99—1999 with Addendum Z21.5.1a–1999.

Gas Fired Absorption Summer Air Conditioning Appliances—ANSI Z21.40.1/CGA 2.91–M961996.

Gas-Fired Central Furnaces (Except Direct Vent System Central Furnaces)—ANSI Z21.47–1990 with Addendum Z21.47a–1990 and Z21.47b–1992.

Household Cooking Gas Appliances—ANSI Z21.1–2000.

Refrigerators Using Gas Fuel—ANSI Z21.19–1990, with Addendum ANSI Z21.19a–1992 and Z21.19b–1995.

Gas Water Heaters—Volume 1, Storage Water Heaters with Input Ratings of 75,000 BTU per hour or Less—ANSI Z21.10.1–1998 with Addendum Z21.10.1a–2000.

Household Electric Storage Tank Water Heaters, Tenth Edition—UL 174–1996, with 1997 revisions.

FERROUS PIPE AND FITTINGS

Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless—ASTM A53–93.

Standard Specification for Electric-Resistance-Welded Coiled Steel Tubing for Gas and Fuel Oil Lines—ASTM A539–1999.

Pipe Threads, General Purpose (Inch)—ANSI/ASME B1.20.1–1983.

Welding and Seamless Wrought Steel Pipe—ANSI/ASME B36.10–1979.

NONFERROUS PIPE, TUBING, AND FITTINGS

Standard Specification for Seamless Copper Water Tube—ASTM B88–93.

Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service—ASTM B280, A–95.

Connectors for Gas Appliances—ANSI Z21.24/CGA 6.10–M97–1997.

Manually Operated Gas Valves for Appliances, Appliance Connector Valves and Hose End Valves—ANSI Z21.15/CGA 9.1–M97–1997.

Standard for Gas Supply Connectors for Manufactured Homes—IAPMO TSC 9–1997.

Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tubes—ASTM B251–93.

Standard Specification for Seamless Copper Pipe, Standard Sizes—ASTM B42–93.

MISCELLANEOUS

Factory-Made Air Ducts and Connectors, Ninth Edition—UL 181, 1996 with 1998 revisions.

Standard for Safety Closure Systems for use with Rigid Air Ducts and Air Connectors, UL 181A, 1994, with 1998 revisions.

Standard for Safety Closure Systems for use with Flexible Air Ducts and Air Connectors, First Edition—UL 181B, 1995, with 1998 revisions.

Tube Fittings for Flammable and Combustible Fluids, Refrigeration Service, and Marine Use, Sixth Edition—UL 109–1997, with 2001 revisions.

Pigtails and Flexible Hose Connectors for LP-Gas, Seventh Edition—UL 569, 1995 with 2001 revisions.

Roof Jacks for Manufactured Homes and Recreational Vehicles, Eighth Edition—UL 311, 1994, with 1998 revisions.

Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems—ANSI Z21.22/CSA 4.4–M99, 1999.

Automatic Gas Ignition Systems and Components—ANSI Z21.20 with Addendum Z21.20a–2000.

Automatic Valves for Gas Appliances—ANSI Z21.21/CSA 6.5–2000.

Gas Appliance Thermostats—ANSI Z21.23–1989, with Addendum Z21.23a–1991.

Gas Vents, Ninth Edition—UL 441, 1996 with 1999 revisions.

Standard for the Installation of Oil-Burning Equipment, NFPA 31, 1997 Edition.

National Fuel Gas Code—NFPA 54–2002/ANSI Z223.1–2002.

Warm Air Heating and Air Conditioning Systems, NFPA 90B, 1996 Edition.

Liquefied Petroleum Gas Code, NFPA 58–2001 Edition.

Flares for Tubing—SAE–J533b–1992.

Factory-Built Chimneys for Residential Type and Building Heating Appliances, Ninth Edition—UL 103, 1995, with 1999 revisions.

Factory-Built Fireplaces, Seventh Edition—UL 127–1996, with 1999 revisions.

Solid-Fuel Type Room Heaters, Fifth Edition—UL 1482, 1995, with 2000 revisions.

Fireplace Stoves, Eight Edition, with 2000 revisions—UL 737, 1996.

Unitary Air-Conditioning and Air-Source Heat Pump Equipment—ANSI/ARI 210/240–89.

AGA Requirements for Gas Connectors for Connection of Fixed Appliances for Outdoor Installation, Park Trailers, and Manufactured (Mobile) Homes to the Gas Supply—No. 3–87.

[58 FR 55015, Oct. 25, 1993, as amended at 70 FR 72046, Nov. 30, 2005]

§ 3280.704 Fuel supply systems.

(a) *LP—Gas system design and service line pressure.* (1) Systems shall be of the vapor-withdrawal type.

(2) Gas, at a pressure not over 14 inches water column (½ psi), shall be delivered from the system into the gas supply connection.

(b) *LP-gas containers*—(1) *Maximum capacity.* No more than two containers having an individual water capacity of not more than 105 pounds (approximately 45 pounds LP-gas capacity), shall be installed on or in a compartment of any manufactured home.

(2) *Construction of containers.* Containers shall be constructed and marked in accordance with the specifications for LP-Gas Containers of the U.S. Department of Transportation (DOT) or the Rules for Construction of Pressure Vessels 1986, ASME Boiler and Pressure Vessel Code section VIII, Division 1 ASME Containers shall have a design pressure of at least 312.5 psig.

(i) Container supply systems shall be arranged for vapor withdrawal only.

(ii) Container openings for vapor withdrawal shall be located in the vapor space when the container is in service or shall be provided with a suitable internal withdrawal tube which communicates with the vapor space on or near the highest point in the container when it is mounted in service position, with the vehicle on a level surface. Containers shall be permanently and legibly marked in a conspicuous manner on the outside to show the correct mounting position and the position of the service outlet connection. The method of mounting in place shall be such as to minimize the possibility of an incorrect positioning of the container.

(3) *Location of LP-gas containers and systems.* (i) LP-gas containers shall not be installed, nor shall provisions be made for installing or storing any LP-gas container, even temporarily, inside any manufactured home except for listed, completely self-contained hand torches, lanterns, or similar equipment with containers having a maximum water capacity of not more than 2½ pounds (approximately one pound LP-gas capacity).

(ii) Containers, control valves, and regulating equipment, when installed,

shall be mounted on the ''A'' frame of the manufactured home, or installed in a compartment that is vaportight to the inside of the manufactured home and accessible only from the outside. The compartment shall be ventilated at top and bottom to facilitate diffusion of vapors. The compartment shall be ventilated with two vents having an aggregate area of not less than two percent of the floor area of the compartment and shall open unrestricted to the outside atmosphere. The required vents shall be equally distributed between the floor and ceiling of the compartment. If the lower vent is located in the access door or wall, the bottom edge of the vent shall be flush with the floor level of the compartment. The top vent shall be located in the access door or wall with the bottom of the vent not more than 12 inches below the ceiling level of the compartment. All vents shall have an unrestricted discharge to the outside atmosphere. Access doors or panels of compartments shall not be equipped with locks or require special tools or knowledge to open.

(iii) Permanent and removable fuel containers shall be securely mounted to prevent jarring loose, slipping or rotating and the fastenings shall be designed and constructed to withstand static loading in any direction equal to twice the weight of the tank and attachments when filled with fuel, using a safety factor of not less than four based on the ultimate strength of the material to be used.

(4) *LP-gas container valves and accessories.* (i) Valves in the assembly of a two-cylinder system shall be arranged so that replacement of containers can be made without shutting off the flow of gas to the appliance(s). This provision is not to be construed as requiring an automatic change-over device.

(ii) Shutoff valves on the containers shall be protected as follows, in transit, in storage, and while being moved into final utilization by setting into a recess of the container to prevent possibility of their being struck if container is dropped upon a flat surface, or by ventilated cap or collar, fastened to the container, capable of withstanding a blow from any direction equivalent to that of a 30-pound weight dropped 4 feet. Construction shall be such that the blow will not be transmitted to the valve.

(iii) [Reserved]

(iv) Regulators shall be connected directly to the container shutoff valve outlets or mounted securely by means of a support bracket and connected to the container shutoff valve or valves with listed high pressure connections. If the container is permanently mounted the connector shall be as required above or with a listed semi-rigid tubing connector.

(5) *LP-gas safety devices.* (i) DOT containers must be provided with safety relief devices as required by the regulation of the U.S. Department of Transportation. ASME containers must be provided with relief valves in accordance with subsection 2.3.2 of NFPA 58–2001, Standard for the Storage and Handling Liquefied Petroleum Gases. Safety relief valves must have direct communication with the vapor space of the vessel.

(ii) The delivery side of the gas pressure regulator shall be equipped with a safety relief device set to discharge at a pressure not less than two times and not more than three times the delivery pressure of the regulator.

(iii) Systems mounted on the ''A'' frame assembly shall be so located that the discharge from the safety relief devices shall be into the open air and not less than three feet horizontally from any opening into the manufactured home below the level of such discharge.

(iv) Safety relief valves located within liquefied petroleum gas container compartments may be less than three feet from openings provided the bottom vent of the compartment is at the same level or lower than the bottom of any opening into the vehicle, or the compartment is not located on the same wall plane as the opening(s) and is at least two feet horizontally from such openings.

(6) *LP-gas system enclosure and mounting.* (i) Housings and enclosures shall be designed to provide proper ventilation at least equivalent to that specified in § 3280.704(b)(3)(ii).

(ii) Doors, hoods, domes, or portions of housings and enclosures required to be removed or opened for replacement of containers shall incorporate means

for clamping them firmly in place and preventing them from working loose during transit.

(iii) Provisions shall be incorporated in the assembly to hold the containers firmly in position and prevent their movement during transit.

(iv) Containers shall be mounted on a substantial support or a base secured firmly to the vehicle chassis. Neither the container nor its support shall extend below the manufactured home frame.

(c) *Oil tanks*—(1) *Installation*. Oil tanks and listed automatic pumps (oil lifters) installed for gravity flow of oil to heating equipment shall be installed so that the top of the tank is no higher than 8 feet above the appliance oil control and the bottom of the tank is not less than 18 inches above the appliance oil control.

(2) *Auxiliary oil storage tank*. Oil supply tanks affixed to a manufactured home shall be so located as to require filling and draining from the outside and shall be in a place readily available for inspection. If the fuel supply tank is located in a compartment of a manufactured home, the compartment shall be ventilated at the bottom to permit diffusion of vapors and shall be insulated from the structural members of the body. Tanks so installed shall be provided with an outside fill and vent pipe and an approved liquid level gage.

(3) *Shutoff valve*. A readily accessible, approved manual shutoff valve shall be installed at the outlet of an oil supply tank. The valve shall be installed to close against the supply.

(4) *Fuel oil filters*. All oil tanks shall be equipped with an approved oil filter or strainer located downstream from the tank shutoff valve. The fuel oil filter or strainer shall contain a sump with a drain for the entrapment of water.

[40 FR 58752, Dec. 18, 1975. Redesignated at 44 FR 20679, Apr. 6, 1979, as amended at 47 FR 49390, Nov. 1, 1982; 52 FR 4587, Feb. 12, 1987; 58 FR 55016, Oct. 25, 1993; 70 FR 72050, Nov. 30, 2005]

§ 3280.705 Gas piping systems.

(a) *General*. The requirements of this section shall govern the installation of all fuel gas piping attached to any manufactured home. The gas piping supply system shall be designed for a pressure not exceeding 14 inch water column (½ psi) and not less than 7 inch water column (¼ psi). The manufacturer shall indicate in his written installation instructions the design pressure limitations for safe and effective operation of the gas piping system. None of the requirements listed in this section shall apply to the piping supplied as a part of an appliance. All exterior openings around piping, ducts, plenums or vents shall be sealed to resist the entrance of rodents.

(b) *Materials*. All materials used for the installation, extension, alteration, or repair of any gas piping system shall be new and free from defects or internal obstructions. It shall not be permissible to repair defects in gas piping or fittings. Inferior or defective materials shall be removed and replaced with acceptable material. The system shall be made of materials having a melting point of not less than 1,450 F, except as provided in § 3280.705(e). They shall consist of one or more of the materials described in § 3280.705(b) (1) through (4).

(1) Steel or wrought-iron pipe shall comply with ANSI Standard B36.10–1979, Welded and Seamless Wrought Steel Pipe. Threaded brass pipe in iron pipe sizes may be used. Threaded brass pipe shall comply with ASTM B43–91, Standard Specification for Seamless Red Brass Pipe, Standard Sizes.

(2) Fittings for gas piping shall be wrought iron, malleable iron, steel, or brass (containing not more than 75 percent copper).

(3) Copper tubing must be annealed type, Grade K or L, conforming to the Standard Specification for Seamless Copper Water Tube, ASTM B88–93, or must comply with the Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Service, ASTM B280–1995. Copper tubing must be internally tinned.

(4) Steel tubing must have a minimum wall thickness of 0.032 inch for tubing of ½ inch diameter and smaller and 0.049 inch for diameters ½ inch and larger. Steel tubing must be in accordance with ASTM Standard Specification for Electric-Resistance-Welded Coiled Steel Tubing for Gas and Fuel

Oil Lines, ASTM A539–1999, and must be externally corrosion protected.

(c) *Piping design*. Each manufactured home requiring fuel gas for any purpose shall be equipped with a natural gas piping system acceptable for LP-gas. Where fuel gas piping is to be installed in more than one section of an expandable or multiple unit home, the design and construction of the crossover(s) shall be as follows:

(1) All points of crossover shall be readily accessible from the exterior of the home.

(2) The connection(s) between units must be made with a connector(s) listed for exterior use or direct plumbing sized in accordance with § 3280.705(d). A shutoff valve of the non-displaceable rotor type conforming to ANSI Z21.15–1997, Manually Operated Gas Valves for Appliances, Appliances Connector Valves, and Hose End Valves, suitable for outdoor use must be installed at each crossover point upstream of the connection.

(3) The connection(s) may be made by a listed quick disconnect device which shall be designed to provide a positive seal of the supply side of the gas system when such device is separated.

(4) The flexible connector, direct plumbing pipe, or ''quick disconnect'' device shall be provided with protection from mechanical and impact damage and located to minimize the possibility of tampering.

(5) For gas line cross over connections made with either hard pipe or flexible connectors, the crossover point(s) shall be capped on the supply side to provide a positive seal and covered on the other side with a suitable protective covering.

(6) Suitable protective coverings for the connection device(s) when separated, shall be permanently attached to the device or flexible connector.

(7) When a quick disconnect device is installed, a 3 inch by 1¾ inch minimum size tag made of etched, metal-stamped or embossed brass, stainless steel, anodized or alcalde aluminum not less than 0.020 inch thick or other approved material (e.g., 0.005 inch plastic laminates) shall be permanently attached on the exterior wall adjacent to the access to the ''quick disconnect'' device. Each tag shall be legibly inscribed with the following information using letters no smaller than ¼ inch high:

Do Not Use Tools To Separate the ''Quick-Disconnect'' Device

(d) *Gas pipe sizing*. Gas piping systems shall be sized so that the pressure drop to any appliance inlet connection from any gas supply connection, when all appliances are in operation at maximum capacity, is not more than 0.5 inch water column as determined on the basis of test, or in accordance with table 3280.705(d). When determining gas pipe sizing in the table, gas shall be assumed to have a specific gravity of 0.65 and rated at 1000 B.T.U. per cubic foot. The natural gas supply connection(s) shall be not less than the size of the gas piping but shall be not smaller than ¾ inch nominal pipe size.

(e) *Joints for gas pipe*. All pipe joints in the piping system, unless welded or brazed, shall be threaded joints that comply with Pipe Threads, General Purpose (Inch), adopted 25 October 1984, ANSI/ASME B1.20.1–1983. Right and left nipples or couplings shall not be used. Unions, if used, shall be of ground joint type. The material used for welding or brazing pipe connections shall have a melting temperature in excess of 1,000 F.

(f) *Joints for tubing*. (1) Tubing joints shall be made with either a single or a double flare of 45 degrees in accordance with Flares For Tubing, SAE-J533b-1972 or with other listed vibration-resistant fittings, or joints may be brazed with material having a melting point exceeding 1,000 F. Metallic ball sleeve compression-type tubing fittings shall not be used.

(2) Steel tubing joints shall be made with a double-flare in accordance with Flares For Tubing, SAE-J533b-1972.

(g) *Pipe joint compound*. Screw joints shall be made up tight with listed pipe joint compound, insoluble in liquefied petroleum gas, and shall be applied to the male threads only.

(h) *Concealed tubing*. Tubing shall not be run inside walls, floors, partitions, or roofs. Where tubing passes through walls, floors, partitions, roofs, or similar installations, such tubing shall be protected by the use of weather resistant grommets that shall snugly fit

both the tubing and the hole through which the tubing passes.

PART I—MAXIMUM CAPACITY OF DIFFERENT SIZES OF PIPE AND TUBING IN THOUSANDS OF BTU'S PER HOUR OF NATURAL GAS FOR GAS PRESSURES OF 0.5 PSIG OR LESS AND A MAXIMUM PRESSURE DROP OF ½ INCH WATER COLUMN

Iron pipe sizes—Length in feet											Tubing—Length in feet										
I.D.	10	20	30	40	50	60	70	80	90	100	O.D.	10	20	30	40	50	60	70	80	90	100
¼″	43	29	24	20	18	16	15	14	13	12	⅜″	27	18	15	13	11	10	9	9	8	8
⅜″	95	65	52	45	40	36	33	31	29	27	½″	56	38	31	26	23	21	19	18	17	16
½″	175	120	97	82	73	66	61	57	53	50	⅝″	113	78	62	53	47	43	39	37	34	33
¾″	360	250	200	170	151	138	125	118	110	103	¾″	197	136	109	93	83	75	69	64	60	57
1″	680	465	375	320	285	260	240	220	215	195	⅞″	280	193	155	132	117	106	98	91	85	81

PART II [RESERVED]

(i) *Concealed joints.* Piping or tubing joints shall not be located in any floor, wall partition, or similar concealed construction space.

(j) *Gas supply connections.* When gas appliances are installed, at least one gas supply connection shall be provided on each home. The connection shall not be located beneath an exit door. Where more than one connection is provided, the piping system shall be sized to provide adequate capacity from each supply connection.

(k) *Identification of gas supply connections.* Each manufactured home shall have permanently affixed to the exterior skin at or near each gas supply connection or the end of the pipe, a tag of 3 inches by 1¾ inches minimum size, made of etched, metal-stamped or embossed brass, stainless steel, anodized or alcalde aluminum not less than 0.020 inch thick, or other approved material (e.g., 0.005 inch plastic laminates), which reads as follows. The connector capacity indicated on this tag shall be equal to or greater than the total Btuh rating of all intended gas appliances.

COMBINATION LP-GAS AND NATURAL GAS SYSTEM

This gas piping system is designed for use of either liquefied petroleum gas or natural gas.

NOTICE: BEFORE TURNING ON GAS BE CERTAIN APPLIANCES ARE DESIGNED FOR THE GAS CONNECTED AND ARE EQUIPPED WITH CORRECT ORIFICES. SECURELY CAP THIS INLET WHEN NOT CONNECTED FOR USE.

When connecting to lot outlet, use a listed gas supply connector for mobile homes rated at □ 100,000 Btuh or more; □ 250,000 Btuh or more.

Before turning on gas, make certain all gas connections have been made tight, all appliance valves are turned off, and any unconnected outlets are capped.

After turning on gas, test gas piping and connections to appliances for leakage with soapy water or bubble solution, and light all pilots.

The connector capacity indicated on this tag shall be equal to or greater than the total Btuh rating of all intended gas appliances.

(l) *LP-gas supply connectors.* (1) A listed LP-Gas flexible connection conforming to UL 569–1995, Pigtails and Flexible Hose Connectors for LP Gas, or equal must be supplied when LP-Gas cylinders(s) and regulator(s) are supplied.

(2) *Appliance connections.* All gas burning appliances shall be connected to the fuel piping. Materials as provided in § 3280.705(b) or listed appliance connectors shall be used. Listed appliance connectors when used shall not run through walls, floors, ceilings or partitions, except for cabinetry, and shall be 3 feet or less in length or 6 feet or less for cooking appliances. Connectors of aluminum shall not be used outdoors. A manufactured home containing a combination LP-natural-gas-system may be provided with a gas outlet to supply exterior appliances when installed in accordance with the following:

(i) No portion of the completed installation shall project beyond the wall of the manufactured home.

(ii) The outlet must be provided with an approved quick-disconnect device, which must be designed to provide a positive seal on the supply side of the gas system when the appliance is disconnected. A shutoff valve of the non-displaceable rotor type conforming to ANSI Z21.15–1997, Manually Operated Gas Valves, must be installed immediately upstream of the quick-disconnect device. The complete device must be provided as part of the original installation.

(iii) Protective caps or plugs for the ''quick-disconnect'' device, when disconnected, shall be permanently attached to the manufactured home adjacent to the device.

(iv) A tag shall be permanently attached to the outside of the exterior wall of the manufactured home as close as possible to the gas supply connection. The tag shall indicate the type of gas and the Btuh capacity of the outlet and shall be legibly inscribed as follows:

THIS OUTLET IS DESIGNED FOR USE WITH GAS PORTABLE APPLIANCES WHOSE TOTAL INPUT DO NOT EXCEED _____ BTUH. REPLACE PROTECTIVE COVERING OVER CONNECTOR WHEN NOT IN USE.

(3) *Valves*. A shutoff valve must be installed in the fuel piping at each appliance inside the manufactured home structure, upstream of the union or connector in addition to any valve on the appliance and so arranged to be accessible to permit servicing of the appliance and removal of its components. The shutoff valve must be located within 6 feet of any cooking appliance and within 3 feet of any other appliance. A shutoff valve may serve more than one appliance if located as required by this paragraph (3). The shutoff valve must be of the non-displaceable rotor type and conform to ANSI Z21.15–1997, Manually Operated Gas Valves.

(4) *Gas piping system openings*. All openings in the gas piping system shall be closed gas-tight with threaded pipe plugs or pipe caps.

(5) *Electrical ground*. Gas piping shall not be used for an electrical ground.

(6) *Couplings*. Pipe couplings and unions shall be used to join sections of threaded piping. Right and left nipples or couplings shall not be used.

(7) *Hangers and supports*. All gas piping shall be adequately supported by galvanized or equivalently protected metal straps or hangers at intervals of not more than 4 feet, except where adequate support and protection is provided by structural members. Solid-iron-pipe gas supply connection(s) shall be rigidly anchored to a structural member within 6 inches of the supply connection(s).

(8) *Testing for leakage*. (i) Before appliances are connected, piping systems shall stand a pressure of at least six inches mercury or three PSI gage for a period of not less than ten minutes without showing any drop in pressure. Pressure shall be measured with a mercury manometer or slope gage calibrated so as to be read in increments of not greater than one-tenth pound, or an equivalent device. The source of normal operating pressure shall be isolated before the pressure tests are made. Before a test is begun, the temperature of the ambient air and of the piping shall be approximately the same, and constant air temperature be maintained throughout the test.

(ii) After appliances are connected, the piping system shall be pressurized to not less than 10 inches nor more than 14 inches water column and the appliance connections tested for leakage with soapy water or bubble solution.

[40 FR 58752, Dec. 18, 1975, as amended at 42 FR 54383, Oct. 5, 1977. Redesignated at 44 FR 20679, Apr. 6, 1979, as amended at 52 FR 4587, Feb. 12, 1987; 58 FR 55016, Oct. 25, 1993; 70 FR 72050, Nov. 30, 2005]

§ 3280.706 Oil piping systems.

(a) *General*. The requirements of this section shall govern the installation of all liquid fuel piping attached to any manufactured home. None of the requirements listed in this section shall apply to the piping in the appliance(s).

(b) *Materials*. All materials used for the installation extension, alteration, or repair, of any oil piping systems shall be new and free from defects or internal obstructions. The system shall be made of materials having a melting point of not less than 1,450 F, except as provided in § 280.706(d) and (e). They shall consist of one or more of the materials described in § 3280.706(b) (1) through (4).

(1) Steel or wrought-iron pipe shall comply with ANSI B 36.10–1979, Welded and Seamless Wrought Steel Pipe. Threaded copper or brass pipe in iron pipe sizes may be used.

(2) Fittings for oil piping shall be wrought-iron, malleable iron, steel, or brass (containing not more than 75 percent copper).

(3) Copper tubing must be annealed type, Grade K or L conforming to the Standard Specification for Seamless Copper Water Tube, ASTM B88–93, or shall comply with ASTM B280–1995, Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

(4) Steel tubing shall have a minimum wall thickness of 0.032 inch for diameters up to ½ inch and 0.049 inch for diameters ½ inch and larger. Steel tubing shall be constructed in accordance with the Specification for Electric-Resistance-Welded Coiled Steel Tubing for Gas and Field Oil Lines, ASTM, A539–90a, and shall be externally corrosion protected.

(c) *Size of oil piping*. The minimum size of all fuel oil tank piping connecting outside tanks to the appliance

shall be no smaller than ⅜ inch OD copper tubing or ¼ inch IPS. If No. 1 fuel oil is used with a listed automatic pump (fuel lifter), copper tubing shall be sized as specified by the pump manufacturer.

(d) *Joints for oil piping.* All pipe joints in the piping system, unless welded or brazed, shall be threaded joints which comply with ANSI/ASME B1.20.1–1983, Pipe Threads, General Purpose (Inch). The material used for brazing pipe connections shall have a melting temperature in excess of 1,000 F.

(e) *Joints for tubing.* Joints in tubing shall be made with either a single or double flare of the proper degree, as recommended by the tubing manufacturer, by means of listed tubing fittings, or brazed with materials having a melting point in excess of 1,000 F.

(f) *Pipe joint compound.* Threaded joints shall be made up tight with listed pipe joint compound which shall be applied to the male threads only.

(g) *Couplings.* Pipe couplings and unions shall be used to join sections of threaded pipe. Right and left nipples or couplings shall not be used.

(h) *Grade of piping.* Fuel oil piping installed in conjunction with gravity feed systems to oil heating equipment shall slope in a gradual rise upward from a central location to both the oil tank and the appliance in order to eliminate air locks.

(i) *Strap hangers.* All oil piping shall be adequately supported by galvanized or equivalently protected metal straps or hangers at intervals of not more than 4 feet, except where adequate support and protection is provided by structural members. Solid-iron-pipe oil supply connection(s) shall be rigidly anchored to a structural member within 6 inches of the supply connection(s).

(j) *Testing for leakage.* Before setting the system in operation, tank installations and piping shall be checked for oil leaks with fuel oil of the same grade that will be burned in the appliance. No other material shall be used for testing fuel oil tanks and piping. Tanks shall be filled to maximum capacity for the final check for oil leakage.

[40 FR 58752, Dec. 18, 1975. Redesignated at 44 FR 20679, Apr. 6, 1979, as amended at 52 FR 4588, Feb. 12, 1987; 58 FR 55017, Oct. 25, 1993; 70 FR 72050, Nov. 30, 2005]

§ 3280.707 Heat producing appliances.

(a) Heat-producing appliances and vents, roof jacks and chimneys necessary for their installation in manufactured homes shall be listed or certified by a nationally recognized testing agency for use in manufactured homes.

(1) A manufactured home shall be provided with a comfort heating system.

(i) When a manufactured home is manufactured to contain a heating appliance, the heating appliance shall be installed by the manufacturer of the manufactured home in compliance with applicable sections of this subpart.

(ii) When a manufactured home is manufactured for field application of an external heating or combination heating/cooling appliance, preparation of the manufactured home for this external application shall comply with the applicable sections of this part.

(2) Gas and oil burning comfort heating appliances shall have a flue loss of not more than 25 percent, and a thermal efficiency of not less than that specified in nationally recognized standards (*See* § 3280.703).

(b) Fuel-burning heat-producing appliances and refrigeration appliances, except ranges and ovens, shall be of the vented type and vented to the outside.

(c) Fuel-burning appliances shall not be converted from one fuel to another fuel unless converted in accordance with the terms of their listing and the appliance manufacturer's instructions.

(d) *Performance efficiency.* (1) All automatic electric storage water heaters installed in manufactured homes shall have a standby loss not exceeding 43 watts/meter^2 (4 watts/ft^2) of tank surface area. The method of test for standby loss shall be as described in section 4.3.1 of Household Automatic Electric Storage Type Water Heaters, ANSI C72.1–1972.

(2) All gas and oil-fired automatic storage water heaters shall have a recovery efficiency, E, and a standby loss, S, as described below. The method of test of E and S shall be as described in section 2.7 of Gas Water heaters, Vol. I, Storage Water Heaters with Input/Ratings of 75,000 BTU per hour or less, ANSI Z21.10.1–1990, with addendums Z21.10.1a–1991 and Z21.10.1b–1992 except that for oil-fired units. CF=1.0, Q=total gallons of oil consumed and H=total heating value of oil in BTU/gallon.

Storage capacity in gallons	Recovery efficiency	Standby loss
Less than 25	At least 75 percent.	Not more than 7.5 percent.
25 up to 35 ..	00	Not more than 7 percent.
35 or more ...	00	Not more than 6 percent.

(e) Each space heating, cooling or combination heating and cooling system shall be provided with at least one readily adjustable automatic control for regulation of living space temperature. The control shall be placed a minimum of 3 feet from the vertical edge of the appliance compartment door. It shall not be located on an exterior wall or on a wall separating the appliance compartment from a habitable room.

(f) *Oil-fired heating equipment.* All oil-fired heating equipment must conform to Liquid Fuel-burning Heating Appliances for Manufactured Homes and Recreational Vehicles, UL 307A—1995, with 1997 revisions, and be installed in accordance with Standard for the Installation of Oil Burning Equipment, NFPA 31–1997. Regardless of the requirements of the above-referenced standards, or any other standards referenced in this part, the following are not required:

(1) External switches or remote controls which shut off the burner or the flow of oil to the burner, or

(2) An emergency disconnect switch to interrupt electric power to the equipment under conditions of excessive temperature.

[40 FR 58752, Dec. 17, 1975, as amended at 42 FR 54383, Oct. 5, 1977. Redesignated at 44 FR 20679, Apr. 6, 1979, as amended at 47 FR 49391, Nov. 1, 1982; 52 FR 4588, Feb. 12, 1987; 52 FR 47553, Dec. 15, 1987; 58 FR 55017, Oct. 25, 1993; 70 FR 72050, Nov. 30, 2005]

§ 3280.708 Exhaust duct system and provisions for the future installation of a clothes dryer.

(a) *Clothes dryers.* (1) All gas and electric clothes dryers shall be exhausted to the outside by a moisture-lint exhaust duct and termination fitting. When the clothes dryer is supplied by the manufacturer, the exhaust duct and termination fittings shall be completely installed by the manufacturer. However, if the exhaust duct system is subject to damage during transportation, it need not be completely installed at the factory when:

(i) The exhaust duct system is connected to the clothes dryer, and

(ii) A moisture lint exhaust duct system is roughed in and installation instructions are provided in accordance with paragraph (b)(3) or (c) of this section.

(2) A clothes dryer moisture-lint exhaust duct shall not be connected to any other duct, vent or chimney.

(3) The exhaust duct shall not terminate beneath the manufactured home.

(4) Moisture-lint exhaust ducts shall not be connected with sheet metal screws or other fastening devices which extend into the interior of the duct.

(5) Moisture-lint exhaust duct and termination fittings shall be installed in accordance with the appliance manufacturer's printed instructions.

(b) *Provisions for future installation of a gas clothes dryer.* A manufactured home may be provided with ''stubbed in'' equipment at the factory to supply a gas clothes dryer for future installation by the owner provided it complies with the following provisions:

(1) The ''stubbed in'' gas outlet shall be provided with a shutoff valve, the outlet of which is closed by threaded pipe plug or cap;

(2) The ''stubbed in'' gas outlet shall be permanently labeled to identify it for use only as the supply connection for a gas clothes dryer;

(3) A moisture lint duct system consisting of a complete access space (hole) through the wall or floor cavity with a cap or cover on the interior and exterior of the cavity secured in such a manner that they can be removed by a common household tool shall be provided. The cap or cover in place shall limit air infiltration and be designed to

resist the entry of water or rodents. The manufacturer is not required to provide the moisture-lint exhaust duct or the termination fitting. The manufacturer shall provide written instructions to the owner on how to complete the exhaust duct installation in accordance with provisions of § 3280.708(a)(1) through (5).

(c) *Provisions for future installation of electric clothes dryers.* When wiring is installed to supply an electric clothes dryer for future installation by the owner, the manufacturer shall:

(1) Provide a roughed in moisture-lint exhaust duct system consisting of a complete access space (hole) through the wall or floor cavity with a cap or cover on the interior and exterior of the cavity which are secured in such a manner that they can be removed by the use of common household tools. The cap or cover in place shall limit air filtration and be designed to resist the entry of water or rodents into the home. The manufacturer is not required to provide the moisture-lint exhaust duct or the termination fitting;

(2) Install a receptacle for future connection of the dryer;

(3) Provide written instructions on how to complete the exhaust duct installation in accordance with the provisions of paragraphs (a)(1) through (5) of this section.

[42 FR 54383, Oct. 5, 1977. Redesignated at 44 FR 20679, Apr. 6, 1979, as amended at 58 FR 55018, Oct. 25, 1993]

§ 3280.709 Installation of appliances.

(a) The installation of each appliance shall conform to the terms of its listing and the manufacturer's instructions. The installer shall leave the manufacturer's instructions attached to the appliance. Every appliance shall be secured in place to avoid displacement. For the purpose of servicing and replacement, each appliance shall be both accessible and removable.

(b) Heat-producing appliances shall be so located that no doors, drapes, or other such material can be placed or swing closer to the front of the appliance than the clearances specified on the labeled appliances.

(c) Clearances surrounding heat producing appliances shall not be less than the clearances specified in the terms of their listings.

(1) Prevention of storage. The area surrounding heat producing appliances installed in areas with interior or exterior access shall be framed-in or guarded with noncombustible material such that the distance from the appliance to the framing or guarding material is not greater than three inches unless the appliance is installed in compliance with paragraph (c)(2), of this section. When clearance required by the listing is greater than three inches, the guard or frame shall not be closer to the appliance than the distance provided in the listing.

(2) Clearance spaces surrounding heat producing appliances are not required to be framed-in or guarded when:

(i) A space is designed specifically for a clothes washer or dryer;

(ii) Dimensions surrounding the appliance do not exceed three inches; or

(iii) The manufacturer affixes either to a side of an alcove or compartment containing the appliance, or to the appliance itself, in a clearly visible location, a 3″ × 5″ adhesive backed plastic laminated label or the equivalent which reads as follows:

''Warning''

This compartment is not to be used as a storage area. Storage of combustible materials or containers on or near any appliance in this compartment may create a fire hazard. Do not store such materials or containers in this compartment.

(d) All fuel-burning appliances, except ranges, ovens, illuminating appliances, clothes dryers, solid fuel-burning fireplaces and solid fuel-burning fireplace stoves, shall be installed to provide for the complete separation of the combustion system from the interior atmosphere of the manufactured home. Combustion air inlets and flue gas outlets shall be listed or certified as components of the appliance. The required separation may be obtained by:

(1) The installation of direct vent system (sealed combustion system) appliances, or

(2) The installation of appliances within enclosures so as to separate the appliance combustion system and venting system from the interior atmosphere of the manufactured home. There

shall not be any door, removable access panel, or other opening into the enclosure from the inside of the manufactured home. Any opening for ducts, piping, wiring, etc., shall be sealed.

(e) A forced air appliance and its return-air system shall be designed and installed so that negative pressure created by the air-circulating fan cannot affect its or another appliance's combustion air supply or act to mix products of combustion with circulating air.

(1) The air circulating fan of a furnace installed in an enclosure with another fuel-burning appliance shall be operable only when any door or panel covering an opening in the furnace fan compartment or in a return air plenum or duct is in the closed position. This does not apply if both appliances are direct vent system (sealed combustion system) appliances.

(2) If a warm air appliance is installed within an enclosure to conform to § 3280.709(d)(2), each warm-air outlet and each return air inlet shall extend to the exterior of the enclosure. Ducts, if used for that purpose, shall not have any opening within the enclosure and shall terminate at a location exterior to the enclosure.

(3) Cooling coils installed as a portion of, or in connection with, any forced-air furnace shall be installed on the downstream side unless the furnace is specifically otherwise listed.

(4) An air conditioner evaporator section shall not be located in the air discharge duct or plenum of any forced-air furnace unless the manufactured home manufacturer has complied with certification required in § 3280.511.

(5) If a cooling coil is installed with a forced-air furnace, the coil shall be installed in accordance with its listing. When a furnace-coil unit has a limited listing, the installation must be in accordance with that listing.

(6) When an external heating appliance or combination cooling/heating appliance is to be field installed, the home manufacturer shall make provision for proper location of the connections to the supply and return air systems. The manufacturer is not required to provide said appliance(s). The preparation by the manufacturer for connection to the home's supply and return air system shall include all fittings and connection ducts to the main duct and return air system such that the installer is only required to provide:

(i) The appliance;

(ii) Any appliance connections to the home; and

(iii) The connecting duct between the external appliance and the fitting installed on the home by the manufacturer. The above connection preparations by the manufacturer do not apply to supply or return air systems designed only to accept external cooling (i.e., self contained air conditioning systems, etc.)

(7) The installation of a self contained air conditioner comfort cooling appliance shall meet the following requirements:

(i) The installation on a duct common with an installed heating appliance shall require the installation of an automatic damper or other means to prevent the cooled air from passing through the heating appliance unless the heating appliance is certified or listed for such application and the supply system is intended for such an application.

(ii) The installation shall prevent the flow of heated air into the external cooling appliance and its connecting ducts to the manufactured home supply and return air system during the operation of the heating appliance installed in the manufactured home.

(iii) The installation shall prevent simultaneous operation of the heating and cooling appliances.

(f) *Vertical clearance above cooking top.* Ranges shall have a vertical clearance above the cooking top of not less than 24 inches. (See § 3280.204).

(g) Solid fuel-burning factory-built fireplaces and fireplace stoves listed for use in manufactured homes may be installed in manufactured homes provided they and their installation conform to the following paragraphs. A fireplace or fireplace stove shall not be considered as a heating facility for determining compliance with subpart F.

(1) A solid fuel-burning fireplace or fireplace stove shall be equipped with integral door(s) or shutter(s) designed to close the fireplace or fireplace stove fire chamber opening and shall include complete means for venting through

the roof, a combustion air inlet, a hearth extension, and means to securely attach the fireplace or the fireplace stove to the manufactured home structure. The installation shall conform to the following paragraphs (g)(1)(i) to (vii) inclusive:

(i) A listed factory-built chimney designed to be attached directly to the fireplace or fireplace stove shall be used. The listed factory built chimney shall be equipped with and contain as part of its listing a termination device(s) and a spark arrester(s).

(ii) A fireplace or fireplace stove, air intake assembly, hearth extension and the chimney shall be installed in accordance with the terms of their listings and their manufacturer's instructions.

(iii) The combustion air inlet shall conduct the air directly into the fire chamber and shall be designed to prevent material from the hearth dropping onto the area beneath the manufactured home.

(iv) The fireplace or fireplace stove shall not be installed in a sleeping room.

(v) Hearth extension shall be of noncombustible material not less than ⅜-inch thick. The hearth shall extend at least 16 inches in front or and at least 8 inches beyond each side of the fireplace or fireplace stove opening. Furthermore the hearth shall extend over the entire surface beneath a fireplace stove and beneath an elevated or overhanging fireplace.

(vi) The label on each solid fuel-burning fireplace and solid fuel-burning fireplace stove shall include the following wording: For use with solid fuel only.

(vii) The chimney shall extend at least three feet above the part of the roof through which it passes and at least two feet above the highest elevation of any part of the manufactured home within 10 feet of the chimney. Portions of the chimney and termination that exceed an elevation of 13½ ft. above ground level may be designed to be removed for transporting the manufactured home.

(h) A corrosion resistant water drip collection and drain pan must be installed under each water heater that will allow water leaking from the water heater to drain to the exterior of the manufactured home, or to a drain.

[40 FR 58752, Dec. 18, 1975. Redesignated at 44 FR 20679, Apr. 6, 1979, as amended at 44 FR 66195, Nov. 19, 1979; 58 FR 55018, Oct. 25, 1993; 70 FR 72050, Nov. 30, 2005]

§ 3280.710 Venting, ventilation and combustion air.

(a) The venting as required by § 3280.707(b) shall be accomplished by one or more of the methods given in (a)(1) and (2) of this section:

(1) An integral vent system listed or certified as part of the appliance.

(2) A venting system consisting entirely of listed components, including roof jack, installed in accordance with the terms of the appliance listing and the appliance manufacturer's instructions.

(b) Venting and combustion air systems shall be installed in accordance with the following:

(1) Components shall be securely assembled and properly aligned at the factory in accordance with the appliance manufacturer's instructions except vertical or horizontal sections of a fuel fired heating appliance venting system that extend beyond the roof line or outside the wall line may be installed at the site. Sectional venting systems shall be listed for such applications and installed in accordance with the terms of their listings and manufacturers' instructions. In cases where sections of the venting system are removed for transportation, a label shall be permanently attached to the appliance indicating the following:

Sections of the venting system have not been installed. Warning-do not operate the appliance until all sections have been assembled and installed in accordance with the manufacturer's instructions.

(2) Draft hood connectors shall be firmly attached to draft hood outlets or flue collars by sheet metal screws or by equivalent effective mechanical fasteners.

(3) Every joint of a vent, vent connector, exhaust duct and combustion air intake shall be secure and in alignment.

(c) Venting systems shall not terminate underneath a manufactured home.

(d) Venting system terminations shall be not less than three feet from

any motor-driven air intake discharging into habitable areas.

(e) The area in which cooking appliances are located shall be ventilated by a metal duct which may be single wall, not less than 12.5 square inches in cross-sectional area (minimum dimension shall be two inches) located above the appliance(s) and terminating outside the manufactured home, or by listed mechanical ventilating equipment discharging outside the home, that is installed in accordance with the terms of listing and the manufacturer's instructions. Gravity or mechanical ventilation shall be installed within a horizontal distance of not more than ten feet from the vertical front of the appliance(s).

(f) Mechanical ventilation which exhausts directly to the outside atmosphere from the living space of a home shall be equipped with an automatic or manual damper. Operating controls shall be provided such that mechanical ventilation can be separately operated without directly energizing other energy consuming devices.

[49 FR 32012, Aug. 9, 1984, as amended at 58 FR 55018, Oct. 25, 1993]

§ 3280.711 Instructions.

Operating instructions shall be provided with each appliance. These instructions shall include directions and information covering the proper use and efficient operation of the appliance and its proper maintenance.

§ 3280.712 Marking.

(a) Information on clearances, input rating, lighting and shutdown shall be attached to the appliances with the same permanence as the nameplate, and so located that it is easily readable when the appliance is properly installed or shutdown for transporting of manufactured home.

(b) Each fuel-burning appliance shall bear permanent marking designating the type(s) of fuel for which it is listed.

§ 3280.713 Accessibility.

Every appliance shall be accessible for inspection, service, repair, and replacement without removing permanent construction. For those purposes, inlet piping supplying the appliance shall not be considered permanent construction. Sufficient room shall be available to enable the operator to observe the burner, control, and ignition means while starting the appliance.

[58 FR 55018, Oct. 25, 1993]

§ 3280.714 Appliances, cooling.

(a) Every air conditioning unit or a combination air conditioning and heating unit shall be listed or certified by a nationally recognized testing agency for the application for which the unit is intended and installed in accordance with the terms of its listing.

(1) Mechanical air conditioners shall be rated in accordance with the ARI Standard 210/240–89 Unitary Air Conditioning and Air Source Unitary Heat Pump Equipment and certified by ARI or other nationally recognized testing agency capable of providing follow-up service.

(i) Electric motor-driven unitary cooling systems with rated capacity less than 65,000 BTU/Hr when rated at ARI Standard rating conditions in ARI Standard 210/240–89 Unitary Air-Conditioning and Air-Source Heat Pump Equipment, shall show energy efficiency (EER) values not less than 7.2.

(ii) Heat pumps shall be certified to comply with all the requirements of the ARI Standard 210/240–89 Unitary Air Conditioning and Air Source Unitary Heat Pump Equipment. Electric motor-driven vapor compression heat pumps with supplemental electrical resistance heat shall be sized to provide by compression at least 60 percent of the calculated annual heating requirements for the manufactured home being served. A control shall be provided and set to prevent operation of supplemental electrical resistance heat at outdoor temperatures above 40 F, except for defrost operation.

(iii) Electric motor-driven vapor compression heat pumps with supplemental electric resistance heat conforming to ARI Standard 210/240–89 Unitary Air-Conditioning and Air-Source Heat Pump Equipment shall show coefficient of performance ratios not less than shown below:

COP

Temperature degrees fahrenheit	Coefficient of performance
47	2.5
17	1.7
0	1.0

(2) Gas fired absorption air conditioners must be listed or certified in accordance with ANSI Z21.40.1–1996, Gas Fired, Heat Activated, Air Conditioning and Heat Pump Appliances, and certified by a nationally recognized testing agency capable of providing follow-up service.

(3) Direct refrigerating systems serving any air conditioning or comfort-cooling system installed in a manufactured home shall employ a type of refrigerant that ranks no lower than Group 5 in the Underwriters' Laboratories, Inc. ''Classification of Comparative Life Hazard of Various Chemicals.''

(4) When a cooling or heat pump coil and air conditioner blower are installed with a furnace or heating appliance, they shall be tested and listed in combination for heating and safety performance by a nationally recognized testing agency.

(5) Cooling or heat pump indoor coils and outdoor sections shall be certified, listed and rated in combination for capacity and efficiency by a nationally recognized testing agency(ies). Rating procedures shall be based on U.S. Department of Energy test procedures.

(b) *Installation and instructions.* (1) The installation of each appliance shall conform to the terms of its listing as specified on the appliance and in the manufacturer's instructions. The installer shall include the manufacturer's installation instructions in the manufactured home. Appliances shall be secured in place to avoid displacement and movement from vibration and road shock.

(2) Operating instructions shall be provided with the appliance.

(c) Fuel-burning air conditioners shall also comply with § 280.707.

(d) The appliance rating plate shall be so located that it is easily readable when the appliance is properly installed.

(e) Every installed appliance shall be accessible for inspection, service, repair and replacement without removing permanent construction.

[40 FR 58752, Dec. 18, 1975. Redesignated at 44 FR 20679, Apr. 6, 1979, as amended at 58 FR 55018, Oct. 25, 1993; 70 FR 72051, Nov. 30, 2005]

§ 3280.715 Circulating air systems.

(a) *Supply system.* (1) Supply ducts and any dampers contained therein shall be made from galvanized steel, tin-plated steel, or aluminum, or shall be listed Class 0, Class 1, or Class 2 air ducts. Class 2 air ducts shall be located at least 3 feet from the furnace bonnet or plenum. A duct system integral with the structure shall be of durable construction that can be demonstrated to be equally resistant to fire and deterioration. Ducts constructed from sheet metal shall be in accordance with the following table:

MINIMUM METAL THICKNESS FOR DUCTS [1]

Duct type	Diameter 14 in. or less	Width over 14 in.
Round	0.013	0.016
Enclosed rectangular	.013	.016
Exposed rectangular	.016	.019

[1] When ''nominal'' thicknesses are specified, 0.003 in. shall be added to these ''minimum'' metal thicknesses.

(2) *Sizing of ducts for heating.* (i) Ducts shall be so designed that when a labeled forced-air furnace is installed and operated continuously at its normal heating air circulating rate in the manufactured home, with all registers in the full open position, the static pressure measured in the casing shall not exceed 90% of that shown on the label of the appliance. For upflow furnaces the static pressure shall be taken in the duct plenum. For external heating or combination heating/cooling appliances the static pressure shall be taken at the point used by the agency listing or certifying the appliance.

(ii) When an evaporator-coil specifically designed for the particular furnace is installed between the furnace and the duct plenum, the total static pressure shall be measured downstream of the coil in accordance with the appliance label and shall not exceed 90 percent of that shown on the label of the appliance.

(iii) When any other listed air-cooler coil is installed between the furnace and the duct plenum, the total static

pressure shall be measured between the furnace and the coil and it shall not exceed 90 percent of that shown on the label of the furnace.

(iv) The minimum dimension of any branch duct shall be at least 1½ inches, and of any main duct, 2½ inches.

(3) *Sizing of ducts.* (i) The manufactured home manufacturer shall certify the capacity of the air cooling supply duct system for the maximum allowable output of ARI certified central air conditioning systems. The certification shall be at operating static pressure of 0.3 inches of water or greater. (See § 3280.511).

(ii) The refrigerated air cooling supply duct system including registers must be capable of handling at least 300 cfm per 10,000 btuh with a static pressure no greater than 0.3 inches of water when measured at room temperature. In the case of application of external self contained comfort cooling appliances or the cooling mode of combination heating/cooling appliances, either the external ducts between the appliance and the manufactured home supply system shall be considered part of, and shall comply with the requirements for the refrigerated air cooling supply duct system, or the connecting duct between the external appliance and the mobile supply duct system shall be a part of the listed appliance. The minimum dimension of any branch duct shall be at least 1½ inches, and of any main duct, 2½ inches.

(4) *Airtightness of supply duct systems.* A supply duct system shall be considered substantially airtight when the static pressure in the duct system, with all registers sealed and with the furnace air circulator at high speed, is at least 80 percent of the static pressure measured in the furnace casing, with its outlets sealed and the furnace air circulator operating at high speed. For the purpose of this paragraph and § 3280.715(b) pressures shall be measured with a water manometer or equivalent device calibrated to read in increments not greater than 1/10 inch water column.

(5) *Expandable or multiple manufactured home connections.* (i) An expandable or multiple manufactured home may have ducts of the heating system installed in the various units. The points of connection must be so designed and constructed that when the manufactured home is fully expanded or coupled, the resulting duct joint will conform to the requirements of this part.

(ii) Installation instructions for supporting the crossover duct from the manufactured home shall be provided for onsite installation. The duct shall not be in contact with the ground.

(6) Air supply ducts shall be insulated with material having an effective thermal resistance (R) of not less than 4.0 unless they are within manufactured home insulation having a minimum effective value of R–4.0 for floors or R–6.0 for ceilings.

(7) Supply and return ducts exposed directly to outside air, such as under chassis crossover ducts or ducts connecting external heating, cooling or combination heating/cooling appliances shall be insulated with material having a minimum thermal resistance of R=4.0, with a continuous vapor barrier having a perm rating of not more than 1 perm. Where exposed underneath the manufactured home, all such ducts shall comply with § 3280.715(a)(5)(ii).

(b) *Return air systems*—(1) *Return air openings.* Provisions shall be made to permit the return of circulating air from all rooms and living spaces, except toilet room(s), to the circulating air supply inlet of the furnace.

(2) *Duct material.* Return ducts and any diverting dampers contained therein shall be in accordance with the following:

(i) Portions of return ducts directly above the heating surfaces, or closer than 2 feet from the outer jacket or casing of the furnace shall be constructed of metal in accordance with § 3280.715(a)(1) or shall be listed Class 0 or Class 1 air ducts.

(ii) Return ducts, except as required by paragraph (a) of this section, shall be constructed of one-inch (nominal) wood boards (flame spread classification of not more than 200), other suitable material no more flammable than one-inch board or in accordance with § 3280.715(a)(1).

(iii) The interior of combustible ducts shall be lined with noncombustible material at points where there might be danger from incandescent

particles dropped through the register or furnace such as directly under floor registers and the bottom return.

(iv) Factory made air ducts used for connecting external heating, cooling or combination heating/cooling appliances to the supply system and return air system of a manufactured home shall be listed by a nationally recognized testing agency. Ducts applied to external heating appliances or combination heating/cooling appliances supply system outlets shall be constructed of metal in accordance with § 3280.715(a)(1) or shall be listed Class 0 or Class 1 air ducts for those portions of the duct closer than 2 feet from the outer casing of the appliance.

(v) Ducts applied to external appliances shall be resistant to deteriorating environmental effects, including but not limited to ultraviolet rays, cold weather, or moisture and shall be resistant to insects and rodents.

(3) *Sizing*. The cross-sectional areas of the return air duct shall not be less than 2 square inches for each 1,000 Btu per hour input rating of the appliance. Dampers shall not be placed in a combination fresh air intake and return air duct so arranged that the required cross-sectional area will not be reduced at all possible positions of the damper.

(4) *Permanent uncloseable openings*. Living areas not served by return air ducts or closed off from the return opening of the furnace by doors, sliding partitions, or other means shall be provided with permanent uncloseable openings in the doors or separating partitions to allow circulated air to return to the furnace. Such openings may be grilled or louvered. The net free area of each opening shall be not less than 1 square inch for every 5 square feet of total living area closed off from the furnace by the door or partition serviced by that opening. Undercutting doors connecting the closed-off space may be used as a means of providing return air area. However, in the event that doors are undercut, they shall be undercut a minimum of 2 inches and not more than 2½ inches, as measured from the top surface of the floor decking to the bottom of the door and no more than one half of the free air area so provided shall be counted as return air area.

(c) *Joints and seams*. Joints and seams of sheet metal and factory-made flexible ducts, including trunks, branches, risers, crossover ducts, and crossover duct plenums, shall be mechanically secured and made substantially airtight. Slip joints in sheet metal ducts shall have a lap of at least one inch and shall be mechanically fastened. Tapes or caulking compounds shall be permitted to be used for sealing mechanically secure joints. Sealants and tapes shall be applied only to surfaces that are dry and dust-, dirt-, oil-, and grease-free. Tapes and mastic closure systems for use with factory-made rigid fiberglass air ducts and air connectors shall be listed in accordance with UL Standard 181A–1994, with 1998 revisions. Tapes and mastic closure systems used with factory-made flexible air ducts and air connectors shall be listed in accordance with UL Standard 181B–1995, with 1998 revisions.

(d) *Supports*. Ducts shall be securely supported.

(e) *Registers and grilles*. Fittings connecting the registers and grilles to the duct system must be constructed of metal or material that complies with the requirements of Class 1 or 2 ducts under UL 181–1996 with 1998 revisions, Factory Made Air Ducts and Connectors. Air supply terminal devices (registers) when installed in kitchen, bedrooms, and bathrooms must be equipped with adjustable closeable dampers. Registers or grilles must be constructed of metal or conform with the following:

(1) Be made of a material classified 94V–0 or 94V–1, when tested as described in UL 94–1996, with 2001 revisions, Test for Flammability of Plastic Materials for Parts in Devices and Appliances, Fifth Edition; and

(2) Floor registers or grilles shall resist without structural failure a 200 lb. concentrated load on a 2-inch diameter disc applied to the most critical area of the exposed face of the register or grille. For this test the register or grille is to be at a temperature of not less than 165 °F and is to be supported

in accordance with the manufacturer's instructions.

[40 FR 58752, Dec. 18, 1975. Redesignated at 44 FR 20679, Apr. 6, 1979, as amended at 52 FR 4589, Feb. 12, 1987; 58 FR 55019, Oct. 25, 1993; 70 FR 72051, Nov. 30, 2005]

Subpart I—Electrical Systems

§ 3280.801 Scope.

(a) Subpart I of this part and Part II of Article 550 of the National Electrical Code (NFPA No. 70–2005) cover the electrical conductors and equipment installed within or on manufactured homes and the conductors that connect manufactured homes to a supply of electricity.

(b) In addition to the requirements of this part and Part II of Article 550 of the National Electrical Code (NFPA No. 70–2005), the applicable portions of other Articles of the National Electrical Code must be followed for electrical installations in manufactured homes. The use of arc-fault breakers under Articles 210.12(A) and (B), 440.65, and 550.25(A) and (B) of the National Electrical Code, NFPA No. 70–2005 is not required. However, if arc-fault breakers are provided, such use must be in accordance with the National Electrical Code, NFPA No. 70–2005. Wherever the requirements of this standard differ from the National Electrical Code, these standards apply.

(c) The provisions of this standard apply to manufactured homes intended for connection to a wiring system nominally rated 120/240 volts, 3-wire AC, with grounded neutral.

(d) All electrical materials, devices, appliances, fittings and other equipment shall be listed or labeled by a nationally recognized testing agency and shall be connected in an approved manner when in service.

(e) Aluminum conductors, aluminum alloy conductors, and aluminum core conductors such as copper clad aluminum; are not acceptable for use in branch circuit wiring in manufactured homes.

[40 FR 58752, Dec. 18, 1975. Redesignated at 44 FR 20679, Apr. 6, 1979, as amended at 58 FR 55019, Oct. 25, 1993; 70 FR 72051, Nov. 30, 2005; 71 FR 19639, Apr. 17, 2006]

§ 3280.802 Definitions.

(a) The following definitions are applicable to subpart I only.

(1) *Accessible* (i) (*As applied to equipment*) means admitting close approach because not guarded by locked doors, elevation, or other effective means. (See *readily accessible*.)

(ii) (*As applied to wiring methods*) means capable of being removed or exposed without damaging the manufactured home structure or finish, or not permanently closed-in by the structure or finish of the manufactured home (see *concealed* and *exposed*).

(2) *Air conditioning or comfort cooling equipment* means all of that equipment intended or installed for the purpose of processing the treatment of air so as to control simultaneously its temperature, humidity, cleanliness, and distribution to meet the requirements of the conditioned space.

(3)(i) *Appliance* means utilization equipment, generally other than industrial, normally built in standardized sizes or types, which is installed or connected as a unit to perform one or more functions, such as clothes washing, air conditioning, food mixing, deep frying, etc.

(ii) *Appliance, fixed* means an appliance which is fastened or otherwise secured at a specific location.

(iii) *Appliance, portable* means an appliance which is actually moved or can easily be moved from one place to another in normal use. For the purpose of this Standard, the following major appliances are considered portable if cord-connected: refrigerators, clothes washers, dishwashers without booster heaters, or other similar appliances.

(iv) *Appliance, stationary* means an appliance which is not easily moved from one place to another in normal use.

(4) *Attachment plug (plug cap) (cap)* means a device which, by insertion in a receptacle, establishes connection between the conductors of the attached flexible cord and the conductors connected permanently to the receptacle.

(5) *Bonding* means the permanent joining of metallic parts to form an electrically conductive path which will assure electrical continuity and the capacity to conduct safely any current likely to be imposed.

(6) *Branch circuit* (i) means the circuit conductors between the final overcurrent device protecting the circuit and the outlet(s). A device not approved for branch circuit protection, such as a thermal cutout or motor overload protective device, is not considered as the overcurrent device protecting the circuit.

(ii) *Branch circuit—appliance* means a branch circuit supplying energy to one or more outlets to which appliances are to be connected, such circuits to have no permanently connected lighting fixtures not a part of an appliance.

(iii) *Branch circuit—general purpose* means a circuit that supplies a number of outlets for lighting and appliances.

(iv) *Branch circuit—individual* means a branch circuit that supplies only one utilization equipment.

(7) *Cabinet* means an enclosure designed either for surface or flush mounting, and provided with a frame, mat, or trim in which swinging doors are hung.

(8) *Circuit breaker* means a device designed to open and close a circuit by nonautomatic means, and to open the circuit automatically on a predetermined overload of current without injury to itself when properly applied within its rating.

(9) *Concealed* means rendered inaccessible by the structure or finish of the manufactured home. Wires in concealed raceways are considered concealed, even though they may become accessible by withdrawing them. (See *accessible (As applied to wiring methods)*)

(10) *Connector, pressure (solderless)* means a device that establishes a connection between two or more conductors or between one or more conductors and a terminal by means of mechanical pressure and without the use of solder.

(11) *Dead front (as applied to switches, circuit-breakers, switchboards, and distribution panelboard)* means so designed, constructed, and installed that no current-carrying parts are normally exposed on the front.

(12) *Demand factor* means the ratio of the maximum demand of a system, or part of a system, to the total connected load of a system or the part of the system under consideration.

(13) *Device* means a unit of an electrical system that is intended to carry but not utilize electrical energy.

(14) *Disconnecting means* means a device, or group of devices, or other means by which the conductors of a circuit can be disconnected from their source of supply.

(15) *Distribution panelboard* means a single panel or a group of panel units designed for assembly in the form of a single panel, including buses, and with or without switches or automatic overcurrent protective devices or both, for the control of light, heat, or power circuits of small individual as well as aggregate capacity; designed to be placed in a cabinet placed in or against a wall or partition and accessible only from the front.

(16) *Enclosed* means surrounded by a case that will prevent a person from accidentally contacting live parts.

(17) *Equipment* means a general term, including material, fittings, devices, appliances, fixtures, apparatus, and the like used as a part of, or in connection with, an electrical installation.

(18) *Exposed* (i) (As applied to live parts) means capable of being inadvertently touched or approached nearer than a safe distance by a person. It is applied to parts not suitably guarded, isolated, or insulated. (See *accessible* and *concealed*.)

(ii) (As applied to *wiring method*) means on or attached to the surface or behind panels designed to allow access. (See *Accessible (as applied to wiring methods)*)

(19) *Externally operable* means capable of being operated without exposing the operator to contact with live parts.

(20) *Feeder assembly* means the overhead or under-chassis feeder conductors, including the grounding conductor, together with the necessary fittings and equipment, or a power supply cord approved for manufactured home use, designed for the purpose of delivering energy from the source of electrical supply to the distribution panelboard within the manufactured home.

(21) *Fitting* means an accessory, such as a locknut, bushing, or other part of a wiring system, that is intended primarily to perform a mechanical rather than an electrical function.

(22) *Ground* means a conducting connection, whether intentional or accidental, between an electrical circuit or equipment and earth, or to some conducting body that serves in place of the earth.

(23) *Grounded* means connected to earth or to some conducting body that serves in place of the earth.

(24) *Grounded conductor* means a system or circuit conductor that is intentionally grounded.

(25) *Grounding conductor* means a conductor used to connect equipment or the grounded circuit of a wiring system to a grounding electrode or electrodes.

(26) *Guarded* means covered, shielded, fenced, enclosed, or otherwise protected by means of suitable covers, casings, barriers, rails, screens, mats or platforms to remove the likelihood of approach or contact by persons or objects to a point of danger.

(27) *Isolated* means not readily accessible to persons unless special means for access are used.

(28) *Laundry area* means an area containing or designed to contain either a laundry tray, clothes washer and/or clothes dryer.

(29) *Lighting outlet* means an outlet intended for the direct connection of a lampholder, a lighting fixture, or a pendant cord terminating in a lampholder.

(30) *Manufactured home accessory building or structure* means any awning, cabana, ramada, storage cabinet, carport, fence, windbreak or porch established for the use of the occupant of the manufactured home upon a manufactured home lot.

(31) *Manufactured home service equipment* means the equipment containing the disconnecting means, overcurrent protective devices, and receptacles or other means for connecting a manufactured home feeder assembly.

(32) *Outlet* means a point on the wiring system at which current is taken to supply utilization equipment.

(33) *Panelboard* means a single panel or group of panel units designed for assembly in the form of a single panel; including buses, automatic overcurrent protective devices, and with or without switches for the control of light, heat, or power circuits; designed to be placed in a cabinet or cutout box placed in or against a wall or partition and accessible only from the front.

(34) *Raceway* means any channel for holding wires, cables, or busbars that is designed expressly for, and used solely for, this purpose. Raceways may be of metal or insulating material, and the term includes rigid metal conduit, rigid nonmetallic conduit, flexible metal conduit, electrical metallic tubing, underfloor raceways, cellular concrete floor raceways, cellular metal floor raceways, surface raceways, structural raceways, wireways, and busways.

(35) *Raintight* means so constructed or protected that exposure to a beating rain will not result in the entrance of water.

(36) *Readily accessible* means capable of being reached quickly for operation, renewal, or inspection, without requiring those to whom ready access is requisite to climb over or remove obstacles or to resort to portable ladders, chairs, etc. (See *Accessible*.)

(37) *Receptacle* means a contact device installed at an outlet for the connection of a single attachment plug. A single receptacle is a single contact device with no other contact device on the same yoke. A multiple receptacle is a single device containing two or more receptacles.

(38) *Receptacle outlet* means an outlet where one or more receptacles are installed.

(39) *Utilization equipment* means equipment which utilizes electric energy for mechanical, chemical, heating, lighting, or similar purposes.

(40) *Voltage (of a circuit)* means the greatest root-mean-square (effective) difference of potential between any two conductors of the circuit concerned. Some systems, such as 3-phase 4-wire, single-phase 3-wire, and 3-wire direct-current may have various circuits of various voltages.

(41) *Weatherproof* means so constructed or protected that exposure to the weather will not interfere with successful operation. Rainproof, raintight, or watertight equipment can fulfill the requirements for weatherproof where varying weather conditions other than wetness, such as snow, ice, dust, or temperature extremes, are not a factor.

§ 3280.803 Power supply.

(a) The power supply to the manufactured home shall be a feeder assembly consisting of not more than one listed 50 ampere manufactured home power-supply cords, or a permanently installed circuit. A manufactured home that is factory-equipped with gas or oil-fired central heating equipment and cooking appliances shall be permitted to be provided with a listed manufactured home power-supply cord rated 40 amperes.

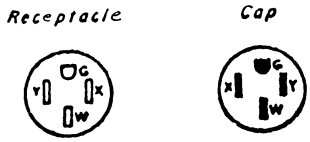
(b) If the manufactured home has a power-supply cord, it shall be permanently attached to the distribution panelboard or to a junction box permanently connected to the distribution panelboard, with the free end terminating in an attachment plug cap.

(c) Cords with adapters and pigtail ends, extension cords, and similar items shall not be attached to, or shipped with, a manufactured home.

(d) A listed clamp or the equivalent shall be provided at the distribution panelboard knockout to afford strain relief for the cord to prevent strain from being transmitted to the terminals when the power-supply cord is handled in its intended manner.

(e) The cord shall be of an approved type with four conductors, one of which shall be identified by a continuous green color or a continuous green color with one or more yellow stripes for use as the grounding conductor.

(f) The attachment plug cap shall be a 3-pole, 4-wire grounding type, rated 50 amperes, 125/250 volts with a configuration as shown herein and intended for use with the 50-ampere, 125/250 receptacle configuration shown. It shall be molded of butyl rubber, neoprene, or other approved materials which have been found suitable for the purpose, and shall be molded to the flexible cord so that it adheres tightly to the cord at the point where the cord enters the attachment-plug cap. If a right-angle cap is used, the configuration shall be so oriented that the grounding member is farthest from the cord.



50-ampere 125/250 volt receptacle and attachment-plug-cap configurations, 3 pole, 4-wire grounding types used for manufactured home supply cords and manufactured home parks. Complete details of the 50-ampere cap and receptacle can be found in the American National Standard Dimensions of Caps, Plugs, and Receptacles, Grounding Type (ANSI/NEMA—WD–6–1997–Wiring Devices–Dimensional Specifications).

(g) The overall length of a power-supply cord, measured from the end of the cord, including bared leads, to the face of the attachment-plug cap shall not be less than 21 feet and shall not exceed 36½ feet. The length of cord from the face of the attachment-plug cap to the point where the cord enters the manufactured home shall not be less than 20 feet.

(h) The power supply cord shall bear the following marking: ''For use with manufactured homes—40 amperes'' or ''For use with manufactured homes—50 amperes.''

(i) Where the cord passes through walls or floors, it shall be protected by means of conduit and bushings or equivalent. The cord may be installed within the manufactured home walls, provided a continuous raceway is installed from the branch-circuit panelboard to the underside of the manufactured home floor. The raceway may be rigid conduit, electrical metallic tubing or polyethylene (PE), polyvinylchloride (PVC) or acrylonitrile-butadiene-styrene (ABS) plastic tubing having a minimum wall thickness of nominal ⅛ inch.

(j) Permanent provisions shall be made for the protection of the attachment-plug cap of the power supply cord and any connector cord assembly or receptacle against corrosion and mechanical damage if such devices are in an exterior location while the manufactured home is in transit.

(k) Where the calculated load exceeds 50 amperes or where a permanent feeder is used, the supply shall be by means of:

(1) One mast weatherhead installation installed in accordance with Article 230 of the National Electrical Code, NFPA No. 70–2005, containing four continuous insulated, color-coded, feeder conductors, one of which shall be an equipment grounding conductor; or

(2) An approved raceway from the disconnecting means in the manufactured home to the underside of the manufactured home with provisions for the attachment of a suitable junction box or fitting to the raceway on the underside of the manufactured home. The manufacturer shall provide in his written installation instructions, the proper feeder conductor sizes for the raceway and the size of the junction box to be used; or

(3) Service equipment installed on the manufactured home in accordance with Article 230 of the National Electrical Code, NFPA No. 70–2005, and the following requirements:

(i) The installation shall be completed by the manufacturer except for the service connections, the meter and the grounding electrode conductor;

(ii) Exterior equipment, or the enclosure in which it is installed must be weatherproof and installed in accordance with Article 312.2(A) of the National Electrical Code, NFPA No. 70–2005, and conductors must be suitable for use in wet locations;

(iii) Each neutral conductor must be connected to the system grounding conductor on the supply side of the main disconnect in accordance with Articles 250.24, 250.26, and 250.28 of the National Electrical Code, NFPA No. 70–2005.

(iv) The manufacturer shall include in its written installation instructions one method of grounding the service equipment at the installation site;

(v) The minimum size grounding electrode conductor shall be specified in the instructions; and

(vi) A red ''Warning'' label shall be mounted on or adjacent to the service equipment. The label shall state:

''Warning—do not provide electrical power until the grounding electrode is installed and connected (see installation instructions).''

[40 FR 58752, Dec. 18, 1975. Redesignated at 44 FR 20679, Apr. 6, 1979, as amended at 52 FR 4589, Feb. 12, 1987; 58 FR 55019, Oct. 25, 1993; 70 FR 72051, Nov. 30, 2005]

§ 3280.804 Disconnecting means and branch-circuit protective equipment.

(a) The branch-circuit equipment is permitted to be combined with the disconnecting means as a single assembly. Such a combination is permitted to be designated as a distribution panelboard. If a fused distribution panelboard is used, the maximum fuse size of the mains must be plainly marked with lettering at least ¼-inch high and that is visible when fuses are changed. (See Article 110.22 of NFPA 70–2005, National Electrical Code, concerning identification of each disconnecting means and each service, feeder, or branch circuit at the point where it originated and the type marking needed.)

(b) Plug fuses and fuseholders shall be tamper-resistant, Type ''S,'' enclosed in dead-front fuse panelboards. Electrical distribution panels containing circuit breakers shall also be dead-front type.

(c) Disconnecting means. A single disconnecting means shall be provided in each manufactured home consisting of a circuit breaker, or a switch and fuses and their accessories installed in a readily accessible location near the point of entrance of the supply cord or conductors into the manufactured home. The main circuit breakers or fuses shall be plainly marked ''Main.'' This equipment shall contain a solderless type of grounding connector or bar for the purposes of grounding with sufficient terminals for all grounding conductors. The neutral bar termination of the grounded circuit conductors shall be insulated.

(d) The disconnecting equipment shall have a rating suitable for the connected load. The distribution equipment, either circuit breaker or fused type, shall be located a minimum of 24 inches from the bottom of such equipment to the floor level of the manufactured home.

(e) A distribution panelboard employing a main circuit breaker shall be rated 50 amperes and employ a 2-pole circuit breaker rated 40 amperes for a 40-ampere supply cord, or 50 amperes for a 50-ampere supply cord. A distribution panelboard employing a disconnect switch and fuses shall be rated 60 amperes and shall employ a single 2-

pole, 60-ampere fuseholder with 40- or 50-ampere main fuses for 40- or 50-ampere supply cords, respectively. The outside of the distribution panelboard shall be plainly marked with the fuse size.

(f) The distribution panelboard shall not be located in a bathroom, or in any other inaccessible location, but shall be permitted just inside a closet entry if the location is such that a clear space of 6 inches to easily ignitable materials is maintained in front of the distribution panelboard, and the distribution panelboard door can be extended to its full open position (at least 90 degrees). A clear working space at least 30 inches wide and 30 inches in front of the distribution panelboard shall be provided. This space shall extend from floor to the top of the distribution panelboard.

(g) Branch-circuit distribution equipment shall be installed in each manufactured home and shall include overcurrent protection for each branch circuit consisting of either circuit breakers or fuses.

(1) The branch circuit overcurrent devices shall be rated:

(i) Not more than the circuit conductors; and

(ii) Not more than 150 percent of the rating of a single appliance rated 13.3 amperes or more which is supplied by an individual branch circuit; but

(iii) Not more than the fuse size marked on the air conditioner or other motor-operated appliance.

(h) A 15-ampere multiple receptacle shall be acceptable when connected to a 20-ampere laundry circuit.

(i) When circuit breakers are provided for branch-circuit protection 240 circuits shall be protected by 2-pole common or companion trip, or handle-tied paired circuit breakers.

(j) A 3 inch by 1–3/4 inch minimum size tag made of etched, metal-stamped or embossed brass, stainless steel, anodized or alclad aluminum not less than 0.020 inch thick, or other approval material (e.g., 0.005 inch plastic laminates) shall be permanently affixed on the outside adjacent to the feeder assembly entrance and shall read: This connection for 120/240 Volt, 3–Pole, 4–Wire, 60 Hertz, _____ Ampere Supply. The correct ampere rating shall be marked on the blank space.

(k) When a home is provided with installed service equipment, a single disconnecting means for disconnecting the branch circuit conductors from the service entrance conductors must be provided in accordance with Article 230, Part VI of the National Electrical Code, NFPA No. 70–2005. The disconnecting means shall be listed for use as service equipment. The disconnecting means may be combined with the disconnect required by § 3280.804(c). The disconnecting means shall be rated not more than the ampere supply or service capacity indicated on the tag required by paragraph (l) of this section.

(l) When a home is provided with installed service equipment, the electrical nameplate required by § 3280.804(j) shall read: ''This connection for 120/240 volt, 3 pole, 3 wire, 60 Hertz, _____ Ampere Supply.'' The correct ampere rating shall be marked in the blank space.

[40 FR 58752, Dec. 18, 1975, as amended at 42 FR 961, Jan. 4, 1977. Redesignated at 44 FR 20679, Apr. 6, 1979, as amended at 52 FR 4589, Feb. 12, 1987; 58 FR 55019, Oct. 25, 1993; 70 FR 72051, Nov. 30, 2005]

§ 3280.805 Branch circuits required.

(a) The number of branch circuits required shall be determined in accordance with the following:

(1) Lighting, based on 3 volt-amperes per square foot times outside dimensions of the manufactured home (coupler excluded) divided by 120 volts times amperes to determine number of 15 or 20 ampere lighting area circuits. e.g. [3 × length × width—[120 × (15 or 20)] = number of 15 or 20 ampere circuits.

(2) *Small appliances*. For the small appliance load in kitchen, pantry dining room and breakfast rooms of manufactured homes, two or more 20-ampere appliance branch circuits, in addition to the branch circuit specified in § 3280.805(a)(1), shall be provided for all receptacle outlets in these rooms, and such circuits shall have no other outlets. Receptacle outlets supplied by at least two appliance receptacle branch circuits shall be installed in the kitchen.

(3) *General appliances* (*Including furnace, water heater, range, and central or room air conditioner, etc.*). There shall be one or more circuits of adequate rating in accordance with the following:

(i) Ampere rating of fixed appliances not over 50 percent of circuit rating if lighting outlets (receptacles, other than kitchen, dining area, and laundry, considered as lighting outlets) are on same circuit;

(ii) For fixed appliances on a circuit without lighting outlets, the sum of rated amperes shall not exceed the branch-circuit rating. Motor loads or other continuous duty loads shall not exceed 80 percent of the branch circuit rating.

(iii) The rating of a single cord and plug connected appliances on a circuit having no other outlets, shall not exceed 80 percent of the circuit rating.

(iv) The rating of the range branch circuit is based on the range demand as specified for ranges in § 3280.811(a)(5). For central air conditioning, see Article 440 of the National Electrical Code, NFPA No. 70–2005.

(v) Where a laundry area is provided, a 20 ampere branch circuit shall be provided to supply laundry receptacle outlets. This circuit shall have no other outlets. See § 3280.806(a)(7).

(b) [Reserved]

[40 FR 58752, Dec. 18, 1975. Redesignated at 44 FR 20679, Apr. 6, 1979, as amended at 58 FR 55020, Oct. 25, 1993; 70 FR 72051, Nov. 30, 2005]

§ 3280.806 Receptacle outlets.

(a) All receptacle outlets shall be:

(1) Of grounding type;

(2) Installed according to Article 406.3 of the National Electrical Code, NFPA No. 70–2005.

(3) Except when supplying specific appliances, be parallel-blade, 15-ampere, 125-volt, either single or duplex.

(b) All 120 volt single phase, 15 and 20 ampere receptacle outlets, including receptacles in light fixtures, installed outdoors, in compartments accessible from the outdoors, in bathrooms, and within 6 feet of a kitchen sink to serve counter top surfaces shall have ground-fault circuit protection for personnel. Feeders supplying branch circuits may be protected by a ground-fault circuit-interrupter in lieu of the provision for such interrupters specified above. Receptacles dedicated for washer and dryers, also located in a bathroom, are exempt from this requirement.

(c) There shall be an outlet of the grounding type for each cord-connected fixed appliance installed.

(d) Receptacle outlets required. Except in the bath and hall areas, receptacle outlets shall be installed at wall spaces 2 feet wide or more, so that no point along the floor line is more than 6 feet, measured horizontally, from an outlet in that space. In addition, a receptacle outlet shall be installed:

(1) Over or adjacent to counter tops in the kitchen (at least one on each side of the sink if counter tops are on each side and 12 inches or over in width).

(2) Adjacent to the refrigerator and free-standing gas-range space. A duplex receptacle may serve as the outlet for a countertop and a refrigerator.

(3) At counter top spaces for built-in vanities.

(4) At counter top spaces under wall-mounted cabinets.

(5) In the wall, at the nearest point where a bar type counter attaches to the wall.

(6) In the wall at the nearest point where a fixed room divider attaches to the wall.

(7) In laundry areas within 6 feet of the intended location of the appliance(s).

(8) At least one receptacle outlet shall be installed outdoors.

(9) At least one wall receptacle outlet shall be installed in bathrooms within 36 inches (914 mm) of the outside edge of each basin. The receptacle outlet must be located on a wall that is adjacent to the basin location. This receptacle is in addition to any receptacle that is part of a lighting fixture or appliance. The receptacle must not be enclosed within a bathroom cabinet or vanity.

(10) Receptacle outlets are not required in the following locations:

(i) Wall space occupied by built-in kitchen or wardrobe cabinets,

(ii) Wall space behind doors which may be opened fully against a wall surface,

(iii) Room dividers of the lattice type, less than 8 feet long, not solid within 6 inches of the floor,

(iv) Wall space afforded by bar type counters.

(e) Receptacle outlets shall not be installed in or within reach (30 inches) of a shower or bathtub space.

(f) Receptacle outlets shall not be installed above electric baseboard heaters.

[40 FR 58752, Dec. 18, 1975. Redesignated at 44 FR 20679, Apr. 6, 1979, as amended at 58 FR 55020, Oct. 25, 1993; 70 FR 72052, Nov. 30, 2005]

§ 3280.807 Fixtures and appliances.

(a) Electrical materials, devices, appliances, fittings, and other equipment installed, intended for use in, or attached to the manufactured home shall be approved for the application and shall be connected in an approved manner when in service. Facilities shall be provided to securely fasten appliances when the manufactured home is in transit. (See § 3280.809.)

(b) Specifically listed pendant-type fixtures or pendant cords shall be permitted in manufactured homes.

(c) If a lighting fixture is provided over a bathtub or in a shower stall, it must be of the enclosed and gasketed type, and be listed for use in wet locations. See also Article 410.4(D) of the National Electrical Code, NFPA No. 70–2005.

(d) The switch for shower lighting fixtures and exhaust fans located over a tub or in a shower stall shall be located outside the tub shower space. (See § 3280.806(e).)

(e) Any combustible wall or ceiling finish exposed between the edge of a fixture canopy, or pan and an outlet box shall be covered with non-combustible or limited combustible material.

(f) Every appliance shall be accessible for inspection, service, repair, or replacement without removal of permanent construction.

[40 FR 58752, Dec. 18, 1975. Redesignated at 44 FR 20679, Apr. 6, 1979, as amended at 52 FR 35543, Sept. 22, 1987; 58 FR 55020, Oct. 25, 1993; 70 FR 72052, Nov. 30, 2005]

§ 3280.808 Wiring methods and materials.

(a) Except as specifically permitted by this part, the wiring methods and materials specified in the National Electrical Code, NFPA No. 70–2005, must be used in manufactured homes.

(b) Nonmetallic outlet boxes shall be acceptable only with nonmetallic cable.

(c) Nonmetallic cable located 15 inches or less above the floor, if exposed, shall be protected from physical damage by covering boards, guard strips, or conduit. Cable likely to be damaged by stowage shall be so protected in all cases.

(d) Nonmetallic sheathed cable shall be secured by staples, straps, or similar fittings so designed and installed as not to injure any cable. Cable shall be secured in place at intervals not exceeding 4½ feet and within 12 inches from every cabinet, box or fitting.

(e) Metal-clad and nonmetallic cables shall be permitted to pass through the centers of the wide side of 2-inch by 4-inch studs. However, they shall be protected where they pass through 2-inch by 2-inch studs or at other studs or frames where the cable or armor would be less than 1½ inches from the inside or outside surface of the studs when the wall covering materials are in contact with the studs. Steel plates on each side of the cable, or a tube, with not less than No. 16 MSG wall thickness shall be required to protect the cable. These plates or tubes shall be securely held in place.

(f) Where metallic faceplates are used they shall be effectively grounded.

(g) If the range, clothes dryer, or similar appliance is connected by metalclad cable or flexible conduit, a length of not less than three feet of free cable or conduit shall be provided to permit moving the appliance. Type NM or Type SE cable shall not be used to connect a range or a dryer. This shall not prohibit the use of Type NM or Type SE cable between the branch circuit overcurrent protective device and a junction box or range or dryer receptacle.

(h) Threaded rigid metal conduit shall be provided with a locknut inside and outside the box, and a conduit bushing shall be used on the inside. Rigid nonmetallic conduit shall be permitted. Inside ends of the conduit shall be reamed.

(i) Switches shall be rated as follows:

(1) For lighting circuits, switches, shall have a 10-ampere, 120–125 volt rating; or higher if needed for the connected load.

(2) For motors or other loads, switches shall have ampere or horsepower ratings, or both, adequate for loads controlled. (An ''AC general-use'' snap switch shall be permitted to control a motor 2 horsepower or less with full-load current not over 80 percent of the switch ampere rating).

(j) At least 4 inches of free conductor shall be left at each outlet box except where conductors are intended to loop without joints.

(k) When outdoor or under-chassis line-voltage wiring is exposed to moisture or physical damage, it shall be protected by rigid metal conduit. The conductors shall be suitable for wet locations. Electrical metallic tubing may be used when closely routed against frames, and equipment enclosures.

(l) The cables or conductors shall be Type NMC, TW, or equivalent.

(m) Outlet boxes of dimensions less than those required in Table 314.16(A) of the National Electrical Code, NFPA No. 70–2005, are permitted provided the box has been tested and approved for that purpose.

(n) Boxes, fittings, and cabinets shall be securely fastened in place, and shall be supported from a structural member of the home, either directly or by using a substantial brace. Snap-in type boxes provided with special wall or ceiling brackets that securely fasten boxes in walls or ceilings shall be permitted.

(o) Outlet boxes must fit closely to openings in combustible walls and ceilings and must be flush with the finish surface or project therefrom. In walls and ceilings of noncombustible material, outlet boxes and fittings must be installed so that the front edge of the box or fitting will not be set back from the finished surface more than ¼ inch. Plaster, drywall, or plasterboard surfaces that are broken or incomplete must be repaired so that there will be no gaps or open spaces greater than ⅛ inch at the edge of the box or fitting.

(p) Appliances having branch-circuit terminal connections which operate at temperatures higher than 60 °C (140 °F) shall have circuit conductors as described in paragraphs (p) (1) and (2) of this section:

(1) Branch-circuit conductors having an insulation suitable for the temperature encountered shall be permitted to run directly to the appliance.

(2) Conductors having an insulation suitable for the temperature encountered shall be run from the appliance terminal connections to a readily accessible outlet box placed at least one foot from the appliance. These conductors shall be in a suitable raceway which shall extend for at least 4 feet.

(q) A substantial brace for securing a box, fitting, or cabinet must be as described in the National Electrical Code, NFPA 70–2005, Article 314.23(B), or the brace, including the fastening mechanism to attach the brace to the home structure, must withstand a force of 50 lbs. applied to the brace at the intended point(s) of attachment for the box in a direction perpendicular to the surface on which the box is installed.

(r) Where the sheathing of NM cable has been cut or damaged and visual inspection reveals that the conductor and its insulation has not been damaged, it shall be permitted to repair the cable sheath with electrical tape which provides equivalent protection to the sheath.

[40 FR 58752, Dec. 18, 1975. Redesignated at 44 FR 20679, Apr. 6, 1979, as amended at 58 FR 55020, Oct. 25, 1993; 70 FR 72052, Nov. 30, 2005]

§ 3280.809 Grounding.

(a) *General.* Grounding of both electrical and nonelectrical metal parts in a manufactured home shall be through connection to a grounding bus in the manufactured home distribution panelboard. The grounding bus shall be grounded through the green-colored conductor in the supply cord or the feeder wiring to the service ground in the service-entrance equipment located adjacent to the manufactured home location. Neither the frame of the manufactured home nor the frame of any appliance shall be connected to the neutral conductor in the manufactured home.

(b) *Insulated neutral.* (1) The grounded circuit conductor (neutral) shall be insulated from the grounding conductors and from equipment enclosures and other grounded parts. The grounded

(neutral) circuit terminals in the distribution panelboard and in ranges, clothes dryers, counter-mounted cooking units, and wall-mounted ovens shall be insulated from the equipment enclosure. Bonding screws, straps, or buses in the distribution panelboard or in appliances shall be removed and discarded. However, when service equipment is installed on the manufactured home, the neutral and the ground bus may be connected in the distribution panel.

(2) Connection of ranges and clothes dryers with 120/240 volt, 3-wire ratings shall be made with 4 conductor cord and 3 pole, 4-wire grounding type plugs, or by type AC metal clad conductors enclosed in flexible metal conduit. For 120 volt rated devices a 3-conductor cord and a 2-pole, 3-wire grounding type plug shall be permitted.

(c) *Equipment grounding means.* (1) The green-colored grounding wire in the supply cord or permanent feeder wiring shall be connected to the grounding bus in the distribution panelboard or disconnecting means.

(2) In the electrical system, all exposed metal parts, enclosures, frames, lamp fixture canopies, etc., shall be effectively bonded to the grounding terminal or enclosure of the distribution panelboard.

(3) Cord-connected appliances, such as washing machines, clothes dryers, refrigerators, and the electrical system of gas ranges, etc., shall be grounded by means of an approved cord with grounding conductor and grounding-type attachment plug.

(d) *Bonding of noncurrent-carrying metal parts.* (1) All exposed noncurrent-carrying metal parts that may become energized shall be effectively bonded to the grounding terminal or enclosure of the distribution panelboard. A bonding conductor shall be connected between each distribution panelboard and an accessible terminal on the chassis.

(2) Grounding terminals shall be of the solderless type and approved as pressure-terminal connectors recognized for the wire size used. Star washers or other approved paint-penetrating fitting shall be used to bond terminals to chassis or other coated areas. The bonding conductor shall be solid or stranded, insulated or bare and shall be No. 8 copper minimum, or equal. The bonding conductor shall be routed so as not to be exposed to physical damage. Protection can be afforded by the configuration of the chassis.

(3) Metallic gas, water and waste pipes and metallic air-circulating ducts shall be considered bonded if they are connected to the terminal on the chassis (see § 3280.809) by clamps, solderless connectors, or by suitable grounding-type straps.

(4) Any metallic roof and exterior covering shall be considered bonded if (i) the metal panels overlap one another and are securely attached to the wood or metal frame parts by metallic fasteners, and (ii) if the lower panel of the metallic exterior covering is secured by metallic fasteners at a cross member of the chassis by two metal straps per manufactured home unit or section at opposite ends. The bonding strap material shall be a minimum of 4 inches in width of material equivalent to the skin or a material of equal or better electrical conductivity. The straps shall be fastened with paint-penetrating fittings (such as screws and star washers or equivalent).

[40 FR 58752, Dec. 18, 1975. Redesignated at 44 FR 20679, Apr. 6, 1979, as amended at 58 FR 55020, Oct. 25, 1993]

§ 3280.810 Electrical testing.

(a) *Dielectric strength test.* The wiring of each manufactured home shall be subjected to a 1-minute, 900 to 1079 volt dielectric strength test (with all switches closed) between live parts and the manufactured home ground, and neutral and the manufactured home ground. Alternatively, the test may be performed at 1080 to 1250 volts for 1 second. This test shall be performed after branch circuits are complete and after fixtures or appliances are installed. Fixtures or appliances which are listed shall not be required to withstand the dielectric strength test.

(b) Each manufactured home shall be subject to:

(1) A continuity test to assure that metallic parts are properly bonded;

(2) Operational test to demonstrate that all equipment, except water heaters, electric furnaces, dishwashers, clothes washers/dryers, and portable

appliances, is connected and in working order; and

(3) Polarity checks to determine that connections have been properly made. Visual verification shall be an acceptable check.

[58 FR 55020, Oct. 25, 1993]

§ 3280.811 Calculations.

(a) The following method shall be employed in computing the supply cord and distribution-panelboard load for each feeder assembly for each manufactured home and shall be based on a 3-wire, 120/240 volt supply with 120 volt loads balanced between the two legs of the 3-wire system. The total load for determining power supply by this method is the summation of:

(1) Lighting and small appliance load as calculated below:

(i) Lighting volt-amperes: Length time width of manufactured home (outside dimensions exclusive of coupler) times 3 volt-amperes per square foot; e.g. Length × width × 3=lighting volt-amperes.

(ii) Small appliance volt-amperes: Number of circuits time 1,500 volt-amperes for each 20-ampere appliance receptacle circuit (see definition of ''Appliance Portable'' with Note): e.g. Number of circuits × 1,500=small appliance volt-amperes.

(iii) Total volts-amperes: Lighting volts-amperes plus small appliance=total volt-amperes.

(iv) First 3,000 total volts-amperes at 100 percent plus remainder at 35 percent=watts to be divided by 240 volts to obtain current (amperes) per leg.

(2) Nameplate amperes for motors and heater loads (exhaust fans, air conditioners, electric, gas, or oil heating). Omit smaller of air conditioning and heating except include blower motor if used as air conditioner evaporator motor. When an air conditioner is not installed and a 40-ampere power supply cord is provided, allow 15 amperes per leg for air conditioning.

(3) 25 percent of current of largest motor in paragraph (a)(2) of this section.

(4) Total of nameplate amperes for: Disposal, dishwasher, water heater, clothes dryer, wall-mounted oven, cooking units. Where number of these appliances exceeds three, use 75 percent of total.

(5) Derive amperes for free-standing range (as distinguished from separate ovens and cooking units) by dividing values below by 240 volts.

Nameplate rating (in watts)	Use (in watts)
10,000 or less	80 percent of rating.
10,001 to 12,500	8,000.
12,501 to 13,500	8,400.
13,501 to 14,500	8,800.
14,501 to 15,500	9,200.
15,501 to 16,500	9,600.
16,501 to 17,500	10,000.

(6) If outlets or circuits are provided for other than factory-installed appliances, include the anticipated load. The following example is given to illustrate the application of this Method of Calculation:

Example: A manufactured home is 70×10 feet and has two portable appliance circuits, a 1000 volt-ampere 240 volt heater, a 200 volt-ampere 120 volt exhaust fan, a 400 volts-ampere 120 volt dishwasher and a 7000 volt-ampere electric range.

Lighting and small appliance load	Volt-ampheres
Lighting 70×10×3	2,100
Small Appliance	3,000
Total	5,100
1st. 3,000 Volt-Ampheres at 100%	3,000
Remainder (5,100 − 3,000 =2,100, at 35%	735
Total	3,735

	Amperes per leg A	Amperes per leg B
Lighting and small Appliance	15.5	15.5
Heater 240 volt	4.1	4.1
Fan 120 volt	1.7	.....
Dishwasher 120 volt	.....	3.3
Range	23.3	23.3
Total	44.6	46.2

Note: Based on the higher current calculated for either leg, use one 50–A supply cord.

(b) The following is an optional method of calculation for lighting and appliance loads for manufactured homes served by single 3-wire 120/240 volt set of feeder conductors with an ampacity of 100 or greater. The total load for determining the feeder ampacity may be computed in accordance with the following table instead of the method previously specified. Feeder conductors whose demand load is determined by this optional calculation are permitted to have the neutral load

determined by Article 220.61 of the National Electrical Code, NFPA No. 70–2005. The loads identified in the table as ''other load'' and as ''Remainder of other load'' must include the following:

(1) 1500 volt-amperes for each 2-wire, 20-ampere small appliance branch circuit and each laundry branch circuit specified.

(2) 3 volt-amperes per square foot for general lighting and general-use receptacles.

(3) The nameplate rating of all fixed appliances, ranges, wall-mounted ovens, counter-mounted cooking units, and including 4 or more separately controlled space heating loads.

(4) The nameplate ampere or kVA rating of all motors and of all low-power-factor loads.

(5) The largest of the following:

(i) Air conditioning load;

(ii) The 65 percent diversified demand of the central electric space heating load;

(iii) The 65 percent diversified demand of the load of less than four separately-controlled electric space heating units.

(iv) The connected load of four or more separately-controlled electric space heating units.

OPTIONAL CALCULATION FOR MANUFACTURED HOMES WITH 110-AMPERE OR LARGER SERVICE

Load (in kilowatt or kilovoltampere)	Demand factor (percent)
Air-conditioning and cooling including heat pump compressors	100
Central electric space heating	65
Less than 4 separately controlled electric space heating units	65
1st 10 kW of all other load	100
Remainder of other load	40

[40 FR 58752, Dec. 18, 1975. Redesignated at 44 FR 20679, Apr. 6, 1979, as amended at 58 FR 55021, Oct. 25, 1993; 70 FR 72052, Nov. 30, 2005]

§ 3280.812 Wiring of expandable units and dual units.

(a) Expandable or multiple unit manufactured homes shall use fixed-type wiring methods and materials for connecting such units to each other.

(b) Expandable or multiple unit manufactured homes not having permanently installed feeders and which are to be moved from one location to another, shall be permitted to have disconnecting means with branch circuit protective equipment in each unit when so located that after assembly or joining together of units the requirements of § 3280.803 will be met.

§ 3280.813 Outdoor outlets, fixtures, air-conditioning equipment, etc.

(a) Outdoor fixtures and equipment shall be listed for use in wet locations, except that if located on the underside of the home or located under roof extensions or similarly protected locations, they may be listed for use in damp locations.

(b) A manufactured home provided with an outlet designed to energize heating and/or air conditioning equipment located outside the manufactured home, shall have permanently affixed, adjacent to the outlet, a metal tag which reads:

This Connection Is for Air Conditioning Equipment Rated at Not More Than _____ Amperes, at _____ Volts, 60 Hertz. A disconnect shall be located within sight of the appliance.

The correct voltage and ampere ratings shall be given. The tag shall not be less than 0.020 inch, etched Brass, stainless steel, anodized or alclad aluminum or equivalent or other approved material (e.g., .005 inch plastic laminates). The tag shall be not less than 3 inches by 1¾ inches minimum size.

[40 FR 58752, Dec. 18, 1975, as amended at 42 FR 961, Jan. 4, 1977. Redesignated at 44 FR 20679, Apr. 6, 1979, as amended at 58 FR 55021, Oct. 25, 1993]

§ 3280.814 Painting of wiring.

During painting or staining of the manufactured home, it shall be permitted to paint metal raceways (except where grounding continuity would be reduced) or the sheath of the nonmetallic cable. Some arrangement, however, shall be made so that no paint shall be applied to the individual wires, as the color coding may be obliterated by the paint.

§ 3280.815 Polarization.

(a) The identified (white) conductor shall be employed for grounding circuit conductors only and shall be connected to the identified (white) terminal or

lead on receptacle outlets and fixtures. It shall be the unswitched wire in switched circuits, except that a cable containing an identified conductor (white) shall be permitted for single-pole three-way or four-way switch loops where the connections are made so that the unidentified conductor is the return conductor from the switch to the outlet. Painting of the terminal end of the wire shall not be required.

(b) If the identified (white) conductor of a cable is used for other than grounded conductors or for other than switch loops as explained above (for a 240 volt circuit for example), the conductor shall be finished in a color other than white at each outlet where the conductors are visible and accessible.

(c) Green-colored wires or green with yellow stripe shall be used for grounding conductors only.

[40 FR 58752, Dec. 18, 1975. Redesignated at 44 FR 20679, Apr. 6, 1979, as amended at 58 FR 55021, Oct. 25, 1993]

§ 3280.816 Examination of equipment for safety.

The examination or inspection of equipment for safety, according to this standard, shall be conducted under uniform conditions and by organizations properly equipped and qualified for experimental testing, inspections of the run of goods at factories, and service-value determinations through field examinations.

Subpart J—Transportation

§ 3280.901 Scope.

Subpart J of this standard covers the general requirement for designing the structure of the manufactured home to fully withstand the adverse effects of transportation shock and vibration without degradation of the integrated structure or of its component parts and the specific requirements pertaining to the transportation system and its relationship to the structure.

§ 3280.902 Definitions.

(a) *Chassis* means the entire transportation system comprising the following subsystems: drawbar and coupling mechanism, frame, running gear assembly, and lights.

(b) *Drawbar and coupling mechanism* means the rigid assembly, (usually an *A* frame) upon which is mounted a coupling mechanism, which connects the manufactured home's frame to the towing vehicle.

(c) *Frame* means the fabricated rigid substructure which provides considerable support to the affixed manufactured home structure both during transport and on-site; and also provides a platform for securement of the running gear assembly, the drawbar and coupling mechanism.

(d) *Running gear assembly* means the subsystem consisting of suspension springs, axles, bearings, wheels, hubs, tires, and brakes, with their related hardware.

(e) *Lights* means those safety lights and associated wiring required by applicable U.S. Department of Transportation regulations.

(f) *Transportation system*, (Same as chassis, above).

(g) *Highway*, includes all roads and streets to be legally used in transporting the manufactured home.

[40 FR 58752, Dec. 18, 1975. Redesignated at 44 FR 20679, Apr. 6, 1979, as amended at 47 FR 28093, June 29, 1982]

§ 3280.903 General requirements for designing the structure to withstand transportation shock and vibration.

(a) The cumulative effect of highway transportation shock and vibration upon a manufactured home structure may result in incremental degradation of its designed performance in terms of providing a safe, healthy and durable dwelling. Therefore, the manufactured home shall be designed, in terms of its structural, plumbing, mechanical and electrical systems, to fully withstand such transportation forces during its intended life. (See §§ 3280.303(c) and 3280.305(a)).

(b) Particular attention shall be given to maintaining watertight integrity and conserving energy by assuring that structural components in the roof and walls (and their interfaces with vents, windows, doors, etc.) are capable of resisting highway shock and vibration forces during primary and subsequent secondary transportation moves.

(c) In place of an engineering analysis, either of the following may be accepted:

(1) Documented technical data of suitable highway tests which were conducted to simulate transportation loads and conditions; or

(2) Acceptable documented evidence of actual transportation experience which meets the intent of this subpart.

§ 3280.904 Specific requirements for designing the transportation system.

(a) *General.* The entire system (frame, drawbar and coupling mechanism, running gear assembly, and lights) shall be designed and constructed as an integrated, balanced and durable unit which is safe and suitable for its specified use during the intended life of the manufactured home. In operation, the transportation system (supporting the manufactured home structure and its contents) shall effectively respond to the control of the braking, while traveling at applicable towing vehicle in terms of tracking and highway speeds and in normal highway traffic conditions.

NOTE: While the majority of manufactured homes utilize a fabricated steel frame assembly, upon which the manufactured home structure is constructed, it is not the intent of this standard to limit innovation. Therefore, other concepts, such as integrating the frame function into the manufactured home structure, are acceptable provided that such design meets the intent and requirements of this part).

(b) *Specific requirements*—(1) *Drawbar.* The drawbar shall be constructed of sufficient strength, rigidity and durability to safely withstand those dynamic forces experienced during highway transportation. It shall be securely fastened to the manufactured home frame by either a continuous weld or by bolting.

(2) *Coupling mechanism.* The coupling mechanism (which is usually of the socket type) shall be securely fastened to the drawbar in such a manner as to assure safe and effective transfer of the maximum loads, including dynamic loads, between the manufactured home structure and the hitch-assembly of the towing vehicle. The coupling shall be equipped with a manually operated mechanism so adapted as to prevent disengagement of the unit while in operation. The coupling shall be so designed that it can be disconnected regardless of the angle of the manufactured home to the towing vehicle. With the manufactured home parked on level ground, the center of the socket of the coupler shall not be less than 20 inches nor more than 26 inches from ground level.

(3) *Chassis.* The chassis, in conjunction with the manufactured home structure, shall be designed and constructed to effectively sustain the designed loads consisting of the dead load plus a minimum of 3 pounds per square foot floor load, (example: free-standing range, refrigerator, and loose furniture) and the superimposed dynamic load resulting from highway movement but shall not be required to exceed twice the dead load. The integrated design shall be capable of insuring rigidity and structural integrity of the complete manufactured home structure and to insure against deformation of structural or finish members during the intended life of the home.

(4) *Running gear assembly.* (i) The running gear assembly, as part of the chassis, shall be designed to perform, as a balanced system, in order to effectively sustain the designed loads set forth in § 3280.904(b)(3) and to provide for durable dependable safe mobility of the manufactured home. It shall be designed to accept shock and vibration, both from the highway and the towing vehicle and effectively dampen these forces so as to protect the manufactured home structure from damage and fatigue. Its components shall be designed to facilitate routine maintenance, inspection and replacement.

(ii) Location of the running gear assembly shall be determined by documented engineering analysis, taking into account the gross weight (including all contents), total length of the manufactured home, the necessary coupling hitch weight, span distance, and turning radius. The coupling weight shall be not less than 12 percent nor more than 25 percent of the gross weight.

(5) *Spring assemblies.* Spring assemblies (springs, hangers, shackles, bushings and mounting bolts) shall be capable of withstanding all the design loads

as outlined in §3280.904(b)(3) without exceeding maximum allowable stresses for design spring assembly life as recommended by the spring assembly manufacturer. The capacity of the spring system shall assure, that under maximum operating load conditions, sufficient clearance shall be maintained between the tire and manufactured home frame or structure to permit unimpeded wheel movement and for changing tires.

(6) *Axles*. Axles, and their connecting hardware, shall be capable of withstanding all of the design loads outlined in §3280.904(b)(3) without exceeding maximum allowable stresses for design axle life as recommended by the axle manufacturer. The number of axles required to provide a safe tow and good ride characteristics shall be determined and documented by engineering analysis. Those alternatives listed in §3280.903(c) may be accepted in place of such an analysis.

(7) *Hubs and bearings*. Hubs and bearings shall meet the requirements of §3280.904(b)(3) and good engineering practice. Both of these components shall be accessible for inspection, routine maintenance and replacement of parts.

(8) *Tires, wheels and rims*. Tires, wheels and rims shall meet the requirements of §3280.904(b)(3). Tires shall be selected for anticipated usage.

(9) *Brake assemblies*. (i) The number, type, size and design of brake assemblies required to assist the towing vehicle in providing effective control and stopping of the manufactured home shall be determined and documented by engineering analysis. Those alternatives listed in §3280.903(c) may be accepted in place of such an analysis.

(ii) Brakes on the towing vehicle and the manufactured home shall be capable of assuring that the maximum stopping distance from an initial velocity of 20 miles per hour does not exceed 40 feet (U.S. Department of Transportation Regulations).

(10) *Lights and associated wiring*. Highway safety electrical lights and associated wiring shall conform to applicable Federal requirements in terms of location and performance. The manufacturer shall have the option of meeting this requirement by utilizing a temporary light/wiring harness provided by the manufactured home transportation carrier.

PART 3282—MANUFACTURED HOME PROCEDURAL AND ENFORCEMENT REGULATIONS

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