

APA (also known as NIST Standard PS-2-92).

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]

#### § 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 1/8 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:

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(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 <sup>1,2</sup> .....	<sup>3</sup> ±39 PSF	<sup>3</sup> ±47 PSF
Uplift <sup>4</sup> .....	<sup>5</sup> – 27 PSF	– 32 PSF
Main wind force resisting system:		
Shearwalls, Diaphragms and their Fastening and Anchorage Systems <sup>1,2</sup> .....	±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 <sup>4</sup> in all areas; trusses shall be doubled within 3’-0” from each end of the roof.....	<sup>5</sup> – 39 PSF	<sup>5</sup> – 47 PSF
Exterior roof coverings, sheathing and fastenings <sup>4,6,7</sup> in all areas except the following.....	<sup>5</sup> – 39 PSF	<sup>5</sup> – 47 PSF
Within 3’-0” from each gable end (overhang at end wall) of the roof or endwall if no overhang is provided <sup>4,6,7</sup> .....	<sup>5</sup> – 73 PSF	<sup>5</sup> – 89 PSF
Within 3’-0” from the ridge and eave (overhang at sidewall) or sidewall if no eave is provided <sup>4,6,7</sup> .....	<sup>5</sup> – 51 PSF	<sup>5</sup> – 62 PSF
Eaves (Overhangs at Sidewalls) <sup>4,6,7</sup> .....	<sup>5</sup> – 51 PSF	<sup>5</sup> – 62 PSF
Gables (Overhangs at Endwalls) <sup>4,6,7</sup> .....	<sup>5</sup> – 73 PSF	<sup>5</sup> – 89 PSF
Wall studs in sidewalls and endwalls, exterior windows and sliding glass doors (glazing and framing), exterior coverings, sheathing and fastenings <sup>8</sup> :		
Within 3’-0” from each corner of the sidewall and endwall.....	±48 PSF	±58 PSF
All other areas.....	±38 PSF	±46 PSF

NOTES:

<sup>1</sup> 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.

<sup>2</sup> Horizontal drag pressures need not be applied to roof projections when the roof slope does not exceed 20 degrees.

<sup>3</sup> + 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.

<sup>4</sup> Design values in this “Table” are only applicable to roof slopes between 10 degrees (nominal 2/12 slope) and 30 degrees.

<sup>5</sup> 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.

<sup>6</sup> 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.

<sup>7</sup> 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.

<sup>8</sup> 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.

(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.

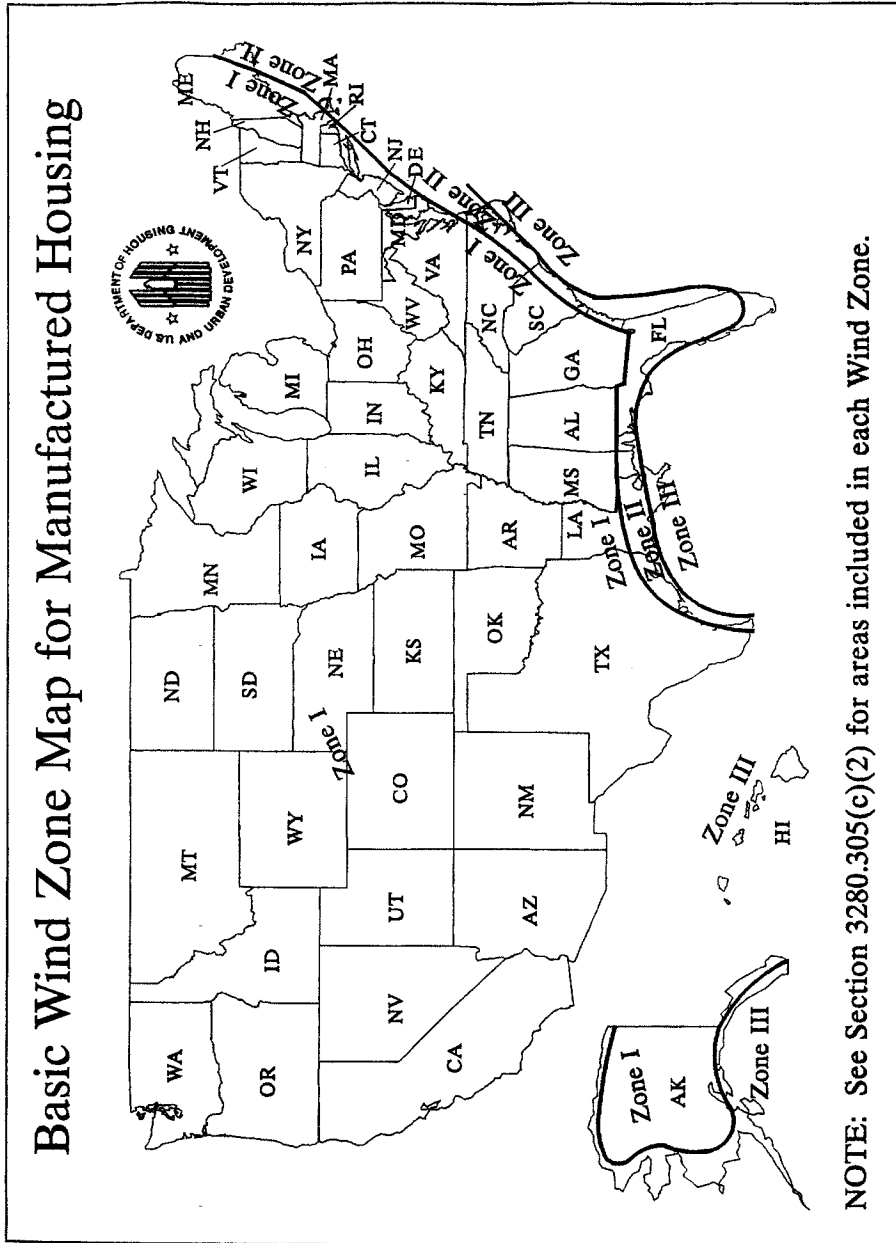
(3) *Snow and roof loads.* (i) Flat, curved and pitched roofs shall be designed to resist the following live loads, applied downward on the horizontal projection as appropriate for the design zone marked on the manufactured home:

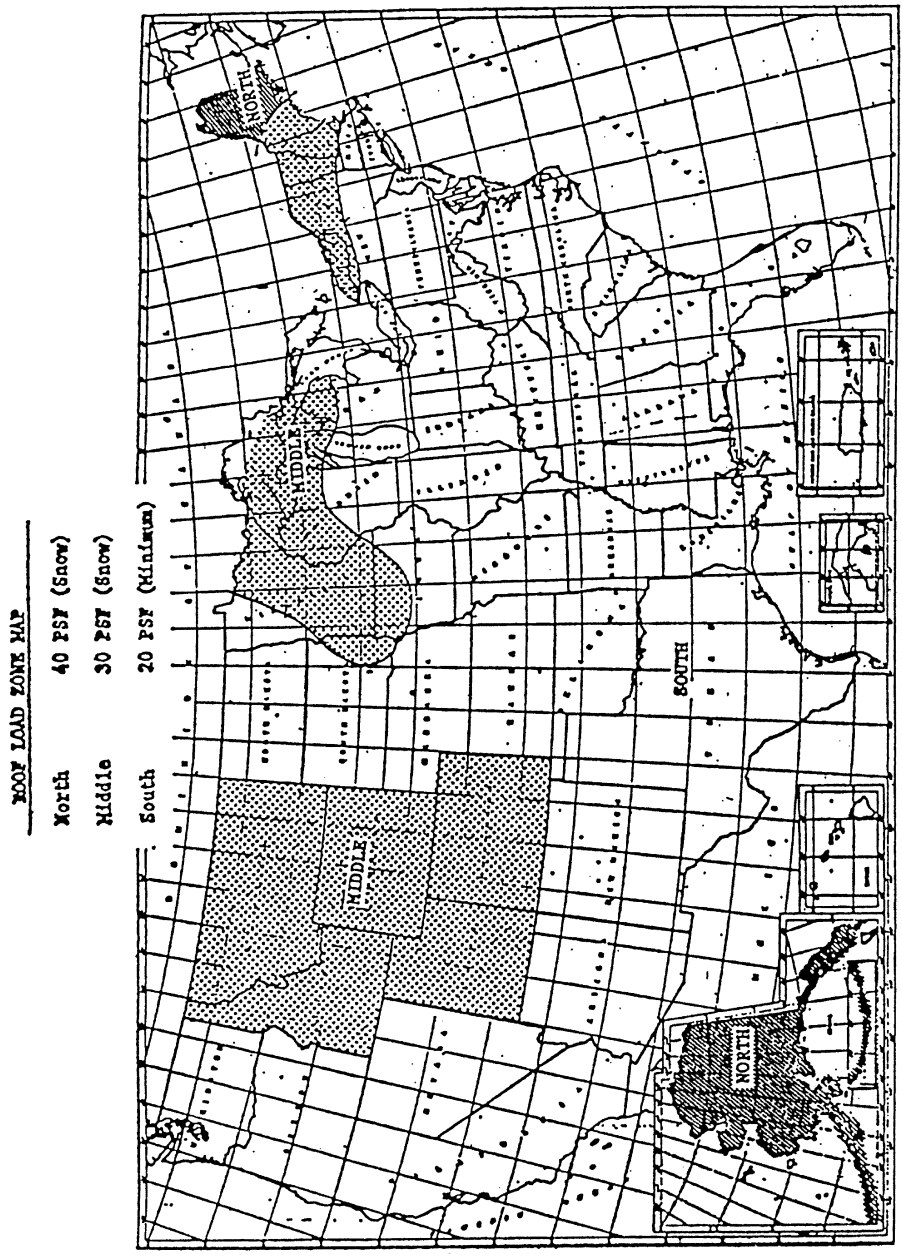
Zone (see Map in § 3280.305(c)(4))	Pounds per square foot
North Zone .....	40
Middle Zone .....	30
South Zone .....	20

(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.

(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.





(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):

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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  $(2 \times L_c)/180$ , where  $L_c$  is the measured horizontal eave projection from the wall.

(e) *Fastening of structural systems.* (1) Roof framing shall be securely fastened to wall framing, walls to floor structure, and floor structure to chassis to secure and maintain continuity between the floor and chassis, so as to resist wind overturning, uplift, and sliding as specified in this part.

(2) For Wind Zones II and III, roof trusses shall be secured to exterior wall framing members (studs), and exterior wall framing members (studs) shall be secured to floor framing members, with 26 gage minimum steel strapping or brackets or by a combination of 26 gage minimum steel strapping or brackets and structural rated wall sheathing that overlaps the roof and floor. Steel strapping or brackets shall be installed at a maximum spacing of 24" on center in Wind Zone II and at a maximum of 16" on center in Wind Zone III. The number and type of fasteners used to secure the steel straps or brackets or structural sheathing shall be capable of transferring all uplift forces between elements being joined.

(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<sup>2</sup> 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-foot 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) 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.

(4) 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.

(5) 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  $\frac{5}{16}$  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) *Welded connections.* (i) All welds shall be made in accordance with the applicable provisions of the Specification for Structural Steel Buildings, Allowable Stress Design and Plastic Design, AISC, June 1, 1989. The Specification for the Design of Cold-Formed Steel Structural Members, AISI-1986 with 1989 addendum, and the Stainless Steel Cold-Formed Structural Design Manual, AISI-1974.

(ii) 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:

(A) Drawbar and coupling mechanisms;

(B) Main member splices, and

(C) Spring hanger to main member connections.

(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.

[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]

#### § 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 shall provide printed instructions with each manufactured home specifying the location and required capacity of stabilizing devices on which the design is based. The manufacturer shall provide drawings and specifications certified by a registered professional engineer or architect indicating at least one acceptable system of anchoring, including the details of 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 should be embedded below the frost line and be at