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.

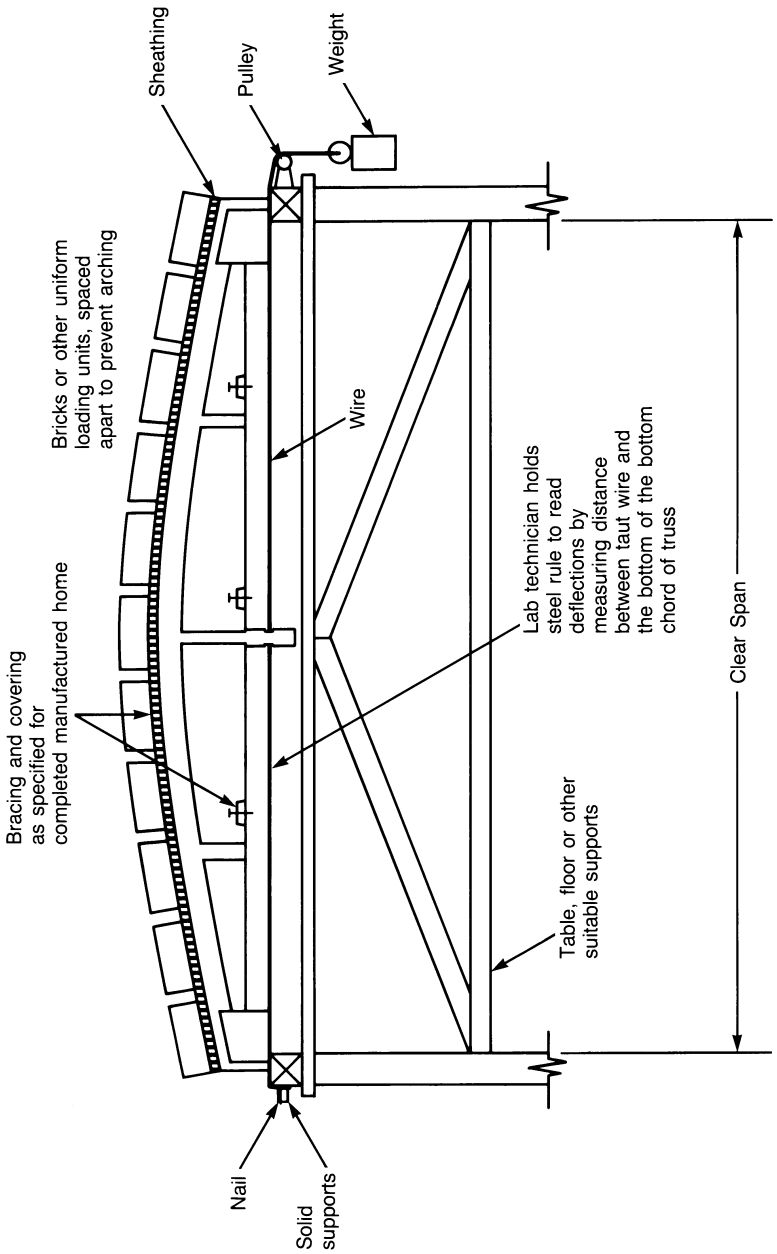


Figure A-1. Test Procedures for Roof Trusses

(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:

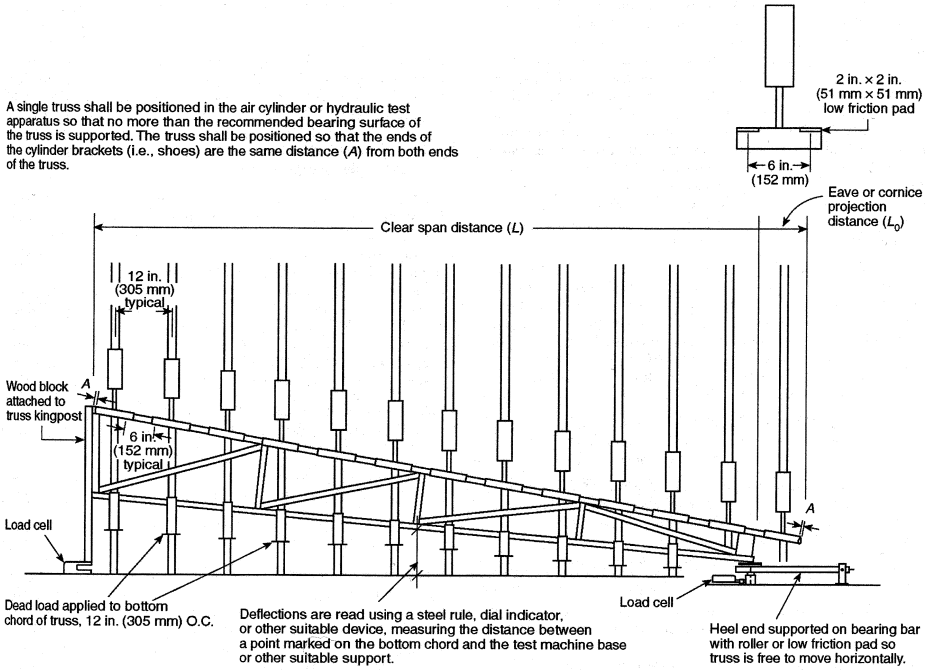
§ 3280.402 Test procedures for roof trusses.

(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.

(l) 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

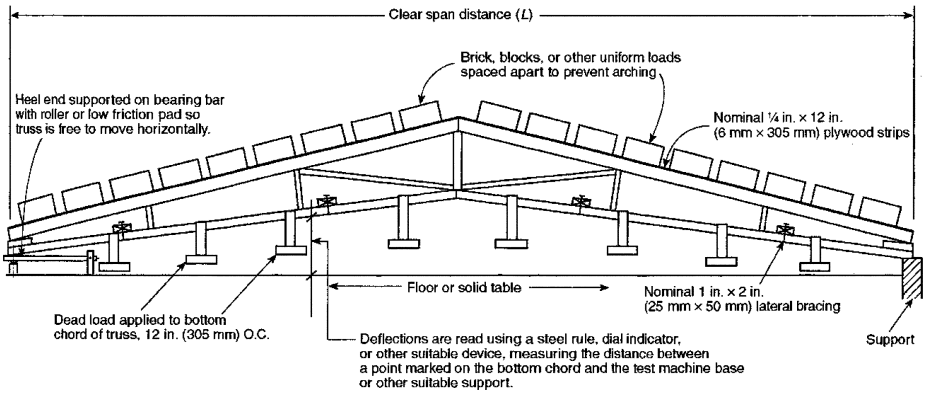


(2) When tested in groups of two or more, the top chords are permitted to be sheathed with nominal 1/4-inch x 12-inch plywood strips. The plywood strips shall be at least long enough to cover the top chords of the trusses at the designated design truss spacing. Adjacent plywood strips shall be separated 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.

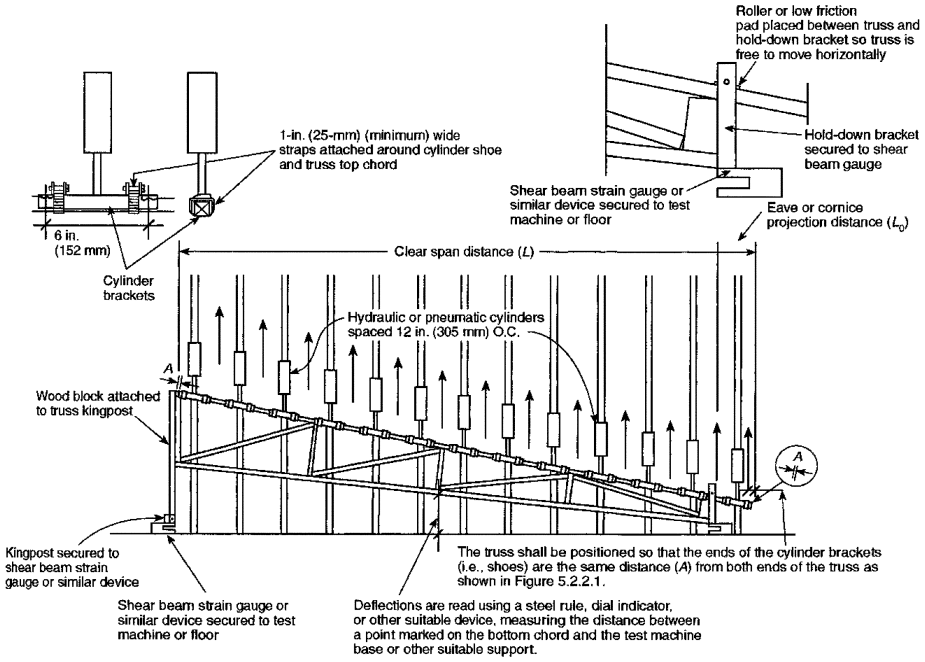
(ii) *Wind Zones II and III uplift loads test.* This test is required for all trusses designed for use in Wind Zones II and III. A minimum of three average quality/consecutive uplift load tests are to be conducted for each truss design when tested in the inverted position and a minimum of two average 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*