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September 30, 2013
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All HUD Code Truss and Manufactured Housing Manufacturers

RE: SUMMARY OF HUD AMENDMENTS TO MANUFACTURED HOUSING TRUSS TEST PROCEDURES

Dear Sir/Madam:

As a follow-up based on previous letters sent, on January 18, 2013 the Department of Housing and Urban Development (HUD) issued the final rule in the Federal Register amending roof truss testing procedures in the Federal Manufactured Home Construction and Safety Standards (FMHCSS). The effective date for implementation of the amendments is **January 13, 2014**.

NTA will assist our truss manufacturers by providing the following services to assure a smooth transition to the amended roof truss testing procedures:

1. NTA will send to our truss clients the updated truss inspection forms for their information. Review of the updated truss inspection forms will give NTA's truss clients an idea of what NTA will be looking for when the new testing procedures are implemented.
2. Truss inspection forms have been updated and will be used by NTA truss inspectors during all 4th quarter truss audits.
3. NTA inspectors conducting 4th quarter truss audits will provide to our truss clients a list of observations noted during the audit. These observations will not require a written response but must be addressed by the truss manufacturer to assure **all homes entering into production on January 13, 2014** are built with trusses that are in compliance with the amendments of 24 CFR 3280.402 (Dated 01-18-2013).

NTA has summarized many of the significant changes to 24 CFR 3280.402 (Dated 01-18-2013). Also attached is a copy of the Federal Register final rule for your review.

1. Effective January 13, 2014 the updated roof truss test procedures will apply to:
 - a. All new truss designs for all wind zones and,
 - b. All existing truss designs for wind zone 2 and 3. Please note that all existing wind zone 1 truss designs will not require initial qualification testing, however, will need to follow the requirements for follow up testing.
2. The following is a comparison chart of the roof truss testing procedures that are current in force and the testing procedures that are effective 01-13-2014.

Comparison of Roof Truss Testing Procedures

Item	Existing Truss Testing Procedures	Testing Procedures (Effective 01-13-2014)
Name	Nondestructive Test Procedure	Proof Load Test Procedure
Number of trusses to be tested	1 Truss minimum	3 Average quality trusses consecutively tested
Overall Test Time	12 Hours at Dead Load plus 1.75 Live Load	12 Hours at Dead Load plus 1.75 Live Load OR 6 Hours at Dead Load plus 2.0 Live Load
Measure 1/4 Live Load Deflections After	5 Minutes	1 Minute after recording each 1/4 live load increment and 5 minutes after full live load plus dead load has been reached.
Deflection at eaves required to be tested and recorded	No	Yes
Name	Destructive Test Procedure	Ultimate Load Test Procedure
Number of trusses to be tested	3 Trusses minimum	2 Average quality trusses consecutively tested
Overall Test Time	5 minutes at Dead Load plus 2.5 Live Load	5 minutes at Dead Load plus 2.5 Live Load
Measure 1/4 Live Load Deflections After	10 Minutes	1 Minute after recording each 1/4 live load increment and 5 minutes after full live load plus dead load has been reached.
Final Recovery Reading	Not Required	Final Recovery Phase requires the Design Live Load only (Dead Load is still applied) to be removed and record deflections within four hours of removing the Live Load.
Deflection at eaves required to be tested and recorded	No	Yes
Name	Uplift Loads	Uplift Load Tests
Number of trusses to be tested	Quantity not specified (Only required for those truss designs which may be critical under uplift load conditions).	Wind Zone 1 Testing is at the discretion of the Registered Engineer or Architect or nationally recognized testing laboratory, however if required, one truss is required to be tested. Wind Zone 2 and 3 Inverted Truss Test 3 Average quality trusses consecutively tested OR Upright Truss Test 2 Average quality trusses consecutively tested
Overall Test Time	3 hours at 1.75 times the design uplift load	Wind Zone 1 If required Inverted - 2.5 times the net wind uplift load for 1 minute Upright - 1.75 times the net wind uplift load for 1 minute Wind Zone 2 and 3 Inverted - 2.0 times the net wind uplift load minus the dead load for 1 minute Upright - 1.75 times the net wind uplift load minus the dead load for 1 minute
Additional Guidance by 3280.402	N/A	Measure and record deflections at dead load plus full live load after 5 minutes. Uplift testing does not require the recovery deflection to be checked or recorded.
Name	Periodic Testing	Follow-Up Testing
Program Requirements	Non-destructive truss test follow up procedure: Subject to a continuing qualification testing program acceptable to HUD Destructive truss test follow up procedure: Subject periodic testing only.	Qualified under the Proof Load Test or Inverted Uplift Test One truss in the first 100 trusses produced and thereafter one truss every 2500 trusses produced or every 6 months whichever is more frequent. Qualified under the Ultimate Load Test or Upright Uplift Test One truss every 4000 trusses produced or every 6 months whichever is more frequent.
Number of trusses to be tested	Not Specified	One truss
Additional Guidance by 3280.402	N/A	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. 3280.402(b) When trusses are tested, eave or cornice distance (L_o) must be included, as shown on the design. The eave or cornice projection loads are applied differently based on the projection length. 3280.402(d)(iv)(B) The following are the requirements:
 - a. Projections greater than 12 inches: Projection load is applied separately and applied to the eave simultaneously with the main body load.
 - b. Projections 12 inches or less: Projection load is added to the main body load and applied to the entire top chord.
4. 3280.402(b)(2)(ii) The nail size used was changed from 6d to 8d.
5. 3280.402(c) Deflection readings must be:
 - a. Taken at the free end of the eave or cornice projection and at the mid span and quarter points of the truss. 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.
 - b. Read and recorded to the nearest 1/32".
 - c. Bottom chord loading must be spaced as uniformly as practical, however, NTA recommends load points to be no more 12" on center.
 - d. Gravity loads must be calculated based on the overall truss length (horizontal projection) including eave or cornice projections.
6. Either the Proof Load Test Procedure or the Ultimate Load Test Procedure may be used by a truss manufacturer. 3280.402(d)
 - a. All tests for initial qualification for trusses must be certified by a Registered Engineer, Architect or nationally recognized testing laboratory.
 - b. An in-house quality control and follow up testing program must be approved prior to any truss entering into production.
7. Proof Load Test Procedure
 3280.402 (d)(1) At least three average quality/consecutively tested trusses must pass all of the following for each truss design:
 - a. Dead load is applied and held for 5 minutes. Deflection readings are recorded after 5 minutes.
 - b. With the Dead Load still applied Live load is applied in approximate 1/4 increments and deflections recorded no sooner than one minute after applying each 1/4 load and 5 minutes after the full live load plus the dead load has been reached.
 - c. The Initial Recovery Phase requires the Live Load to be removed, after 5 minutes deflection readings are to be recorded and the truss is to be loaded to:
 1. Dead Load plus 2.0 times the Live Load for 6 hours OR
 2. Dead Load plus 1.75 times the Live Load for 12 hours.
 3. Failure is rupture, fracture or excessive yielding.
 - d. Final Recovery Phase requires the Design Live Load only (Dead Load is still applied) to be removed and record deflections within four hours of removing the Live Load.
 - e. **All** of the following acceptance criteria must be met for the truss to be acceptable:

1. Maximum deflection between No Load and Dead Load must be:
 1. $L/480$ or less for simple supported clear span
 2. $L_o/180$ or less for eave and cornice projections
 2. Maximum deflection between Dead Load and Live Load must be:
 1. $L/180$ or less for simple supported clear span
 2. $L_o/90$ or less for eave and cornice projections
 3. After the Live Load is removed, and the dead load is still applied the maximum recovery deflection must be:
 1. $L/360$ or less for simple supported clear span
 2. $L_o/180$ or less for eave and cornice projections
 4. The truss must maintain the overload condition for 6 hours without rupture, fracture or excessive yielding **AND**
 5. After 2.0 times the Live Load has been removed and with the Dead Load still applied the maximum recovery deflection must be:
 1. $L/180$ or less for simple supported clear span
 2. $L_o/90$ or less for eave and cornice projections
8. Ultimate Load Test Procedure
- 3280.402 (d)(2) At least two average quality/consecutively tested trusses must pass all of the following for each truss design:
- a. Dead load is applied and held for 5 minutes. Deflection readings are recorded after 5 minutes.
 - b. With the Dead Load still applied, Live load is applied in approximate $\frac{1}{4}$ increments and deflections recorded no sooner than one minute after applying each $\frac{1}{4}$ live load increment and 5 minutes after the full live load plus the dead load has been reached.
 - c. The Initial Recovery Phase requires the Live Load to be removed, after 5 minutes deflection readings are to be recorded.
 - d. The Overload Phase requires the full live load reapplied and additional loading added until the dead load and 2.5 times the design live load is reached. This overload condition is maintained for 5 minutes.
 - e. Final Recovery Phase requires the Design Live Load only (Dead Load is still applied) to be removed and record deflections within four hours of removing the Live Load.
 - f. **All** of the following acceptance criteria must be met for the truss to be acceptable:
 1. Maximum deflection between No Load and Dead Load must be:
 1. $L/480$ or less for simple supported clear span
 2. $L_o/180$ or less for eave and cornice projections
 2. Maximum deflection between Dead Load and Design Live Load must be:
 1. $L/180$ or less for simple supported clear span
 2. $L_o/90$ or less for eave and cornice projections
 3. After the Design Live Load is removed, and the dead load is still applied the maximum recovery deflection must be:
 1. $L/360$ or less for simple supported clear span
 2. $L_o/180$ or less for eave and cornice projections

4. The truss must maintain the overload condition for 5 minutes without rupture, fracture or excessive yielding **AND**
5. After 2.5 times the Design Live Load has been removed and with the Dead Load still applied the maximum recovery deflection must be:
 1. $L/180$ or less for simple supported clear span
 2. $L_o/90$ or less for eave and cornice projections

9. Uplift Load Testing

3280.402(d)(3) – Each truss design must pass all the following requirements:

a. Wind Zone 1:

1. Uplift testing is at the discretion of the Registered Engineer or Architect.
2. Should the Registered Engineer or Architect deem that an uplift test is required the net uplift load of 9 PSF for the clear span remains the same. 22.5 PSF for eave or cornice projections is now required. A minimum of one quality uplift load test must be conducted for each truss design based on the position of the truss when tested. Testing loads are based on the position of the truss when tested as follows:
3. Inverted – 2.5 times the net wind uplift load or
4. Upright – 1.75 times the net wind uplift load

b. Wind Zone 2 and 3: Uplift testing is required for all truss designs and:

1. The following quantity of average quality/consecutive uplift load tests must be conducted for each truss design based on the position of the truss when tested:
 1. Inverted position – 3 tests
 2. Upright position – 2 tests
2. Uplift loading for the clear span and the eave/cornice projections is determined by subtracting the dead load applied to the truss from the uplift load shown in the table of design wind pressures in 3280.305.
3. Testing loads are based on the position of the truss when tested as follows:
 1. Inverted – 2.0 times the net wind uplift load and hold for one minute or
 2. Upright – 1.75 times the net wind uplift load minus the dead load and hold for one minute.
 3. The truss is acceptable for uplift when the truss maintains the overload for one minute without rupture, fracture or excessive yielding.

c. Uplift Test Procedure for Upright Truss Position

1. Place the truss in the test fixture and position as it is intended to be installed in the manufactured home. Position the load measurement devices to register the wind uplift loads that will be applied to the top chord of the truss.
2. 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.

3. Proof Load or Ultimate Load 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.
4. 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.
5. 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.
6. Apply net uplift load and after five (5) minutes measure and record the deflection. Design load deflection shall be $L/180$ or less for a simply supported clear span and $L_o/90$ or less for eave or cornice projections.
7. Continue to load the truss to 1.75 times the net uplift load for Wind Zone I and 1.75 times the uplift load minus the Dead Load for Wind Zones II and III, and maintain the load for one (1) minute.
8. Acceptance Criteria: Truss must maintain the overload for the specified time period without rupture, fracture, or excessive yielding.

d. Uplift Test Procedure for Inverted Truss Position

1. Place the truss in the inverted position in the test fixture. Position the load measurement devices to register the wind uplift loads that will be applied to the top chord of the truss.
2. 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.
3. 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.
4. 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.
5. Apply net uplift load and after five (5) minutes measure and record the deflection. Design load deflection shall be $L/180$ or less for a simply supported clear span and $L_o/90$ or less for eave or cornice projections.

6. Continue to load the truss to 2.50 times the net uplift load in for Wind Zone I and 2.0 times the uplift load minus the Dead Load for Wind Zones II and III, and maintain the load for one (1) minute.
7. Acceptance Criteria Truss must maintain the overload for the specified time period without rupture, fracture, or excessive yielding.

10. Follow Up Testing

3280.402(e): The minimum requirements for truss manufactures quality control follow-up testing are now clearly stated:

- a. For **every truss design** produced for all Wind Zones using the Proof Load Test Procedure OR Inverted Uplift Test Procedure:
 1. One follow up test for the first 100 trusses and,
 2. After the first 100 trusses one follow up test every 2500 trusses OR one follow up test every 6 months whichever is more frequent
- b. For **every truss design** produced for all Wind Zones using the Ultimate Load Test Procedure OR Upright Uplift Test Procedure:
 1. One follow up test for every 4000 trusses produced OR one follow up test every 6 months whichever is more frequent.
- c. Truss designs that are qualified but not in production are not subject to follow up testing until produced. When a truss is brought into production a follow up test is required if the truss design has been out of production for more than 6 months.
- d. 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.

If you have any additional questions or comments regarding the updated truss test procedures please contact me at your convenience at (574) 773-7975.

Respectfully,



Alan Reder
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NTA, Inc.

Reviewed by: Doug Berger

Enclosure(s): Federal Register / Vol.78, No. 13 / Friday, January 18, 2013 / Rules and Regulations

cc: Dale Arter, Doug Berger, Doug Mills, Robert Lee