Post-frame Construction Tolerances
Today’s Presentation:

History – Development of “Tolerance Documents”
Part 1 – Framing Tolerances
Part 2 – Cladding and Trim Tolerances
Where to Find these Documents
Audience Questions and/or User Experiences
WHY did we get “Tolerance Documents”?

1969 – Indiana: Post-Frame Builders needed support for being allowed in the building code.

1993 – Wisconsin: A lawsuit about a poorly constructed post-frame building exposed the lack of appropriate quality standards.
Timeline

1996 Begel and Bohnhoff measure Post-Frame Buildings (Framing)

1997 ASAE Paper #974087 “Accuracy of Post-Frame Building Construction”

1998 ASAE Paper #984002 “Construction Tolerances Standard...” (Framing)

2003/04 Bohnhoff and Cockrum measure Post-Frame Cladding and Trim

2004 Paper #044113 “Quality Assessment of Metal Cladding and Trim...”

2005 ASAE Paper #054117 “Metal Panel and Trim Installation Tolerances”
ACCURACY OF POST-FRAME BUILDING CONSTRUCTION

by

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Written for Presentation: 1997 ASAE Annual International Meeting
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Minneapolis Convention Center
Minneapolis, Minnesota
August 10-14, 1997

Construction Tolerances Standard for Post-Frame Buildings

by

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Orlando, Florida
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NFBA NATIONAL FRAME BUILDING ASSOC.
Quality Assessment of Light-Gauge Metal Cladding and Trim Installation

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Metal Panel and Trim Installation Tolerances

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Abstract: The fourth draft of a document containing installation tolerances for presented. This draft contains an extensive commentary, as well as appendices; panel fabrication tolerances, galvanic action, and panel and trim design/decking.

Keywords: Construction, Construction Tolerances, Metal Panels, Metal Trim, Metal Siding, Siding Installation.
Post-Frame “specific” features considered:

- Post Embedment Depth
- Post & Footing Concentricity
- Posts: Plumb (2 directions), Spacing, Alignment
- Building: Length & Width, Diagonal (squareness)
- Trusses: Height, Bow, Plumb
- Girts: Alignment, slope, spacing, and sag
- Also, Girders and Purlins
Post Embedment Depth

Post embedment minimum = 90% of specified depth.

(If exceeding depth, maintain minimum preservative treatment distance above grade)

Figure 5-2. Preservative-treated wood post foundation.

Source: 2015 PFBDM
Post and Footing Concentricity

*Source: NFBA Accepted Framing Practices*
Post Plumbness

Maximum deviation distance from plumb line:

1% of Post Height

Maximum slope of any post surface:

1.5% from plumb

Figure 4 - Post plumbness criteria.
Post Alignment

- Spacing within 2” of the specified field spacing
- Alignment: Each post within ¾” of the average
- Difference between adjacent posts is within 0.8% of the spacing between posts.

**Figure 5** - Checking alignment of posts 1, 2, 3 and 4 with a line equal distant from each corner post.

Source: NFBA Accepted Framing Practices (color highlights added to show “pass/fail”)

**POST-FRAME CONSTRUCTION TOLERANCES**
Building Size / Post Layout

Opposing Wall Lengths: within 2” of each other

Diagonals within larger of: 2” or 0.5% of the short side

Source: NFBA Accepted Framing Practices
Truss Placement

Source: NFBA Accepted Framing Practices
Truss Placement

**Cross-Sectional View of Truss**

- Truss depth, D
- Plumb line
- Maximum deviation from plumb should be lesser of D/50 or 2 inches

**Figure 9** - Requirements for truss plumbness.

**Top View of Truss**

- Bow should be limited to the lesser of L/200 or 2 inches
- Length, L

**Figure 8** - Restrictions on overall truss bow and bow in truss members.

Source: NFBA Accepted Framing Practices
Girt Placement

- Installed within 3/8” of horizontal line.
- Spacing within ½” of target
- Splices not offset by more than ¼”
- Slope 1% or less at any point
- Sag to be 0.6% of span or less

Source: NFBA Accepted Framing Practices
Girder and Purlin Placement

• Girder height within 1/2” of specified height
• Adjacent Girder bearing point heights within 0.5% of spacing between bearing points
• Spacing between purlin rows within ½” of specified spacing
Metal Panel Plumbness

Clause 4.1.2 Slopes of adjacent wall panels shall not differ by more than 0.3%.

Clause 4.1.3 No edge/rib of a panel shall differ in slope from another edge/rib on the same panel by more than 0.3%.

Clause 4.1.1 No wall panel edge shall deviate from its specified slope by more than 1.0%.

Clause 4.4 The slope of visible, field-cut panel edges shall not deviate from the slope of adjacent panel trim by more than 0.5%.

Figure 9 – Wall panel plumbness criteria.
Wall Panel Positioning

Clause 4.5. Distance from panel end to average (or specified) trim-to-panel end distance shall not exceed 0.12 inches

Average (or specified) trim-to-panel end distance

Upper Wall Panel

Z-Trim

Wainscot

Clause 4.3.2. No offset of adjacent panel ends shall exceed 0.20 inches, and 95% of such offsets shall be less than 0.12 inches

Clause 4.2. Offset between upper wall panel and wainscot ribs shall not exceed 3/8 inches

Figure 10 - Wall panel positioning criteria.
Roof Panel Positioning

• Adjacent roof panel edges not offset more than 0.38"
  ○ 95% of offsets less than 0.24"
• Roof panel overhang shall not differ from average by more than \(\frac{3}{4}\)"
Metal Trim Positioning

- Orientation should not vary more than 1.0% from specified
- Camber shall not exceed lesser of: 0.3% of distance between the two points or .5"

Figure A.1 – Measurement nomenclature for (a) deviation of a component edge from a reference line, (b) component camber.
Metal Trim Positioning

Clause 5.3. The slope of a trim edge shall not deviate from the slope of the nearest panel rib by more than 0.5%.

Clause 5.4. At no point along its length shall the major corner trim bend angle deviate from square (90 degrees) more than 8.0 degrees, nor shall the bend angle change more than 1.0 degree per foot of trim length.

Figure 11 – Trim positioning criteria.
Wall Fastener alignment

• **Horizontal**: distance between any one fastener and a 12-foot line parallel to the row does not deviate from average by more than 0.38"
  - Vertical offset between adjacent fasteners shall not exceed 0.38"

• **Vertical**: Distance between an individual fastener and adjacent rib/seam shall not deviate from the average by more than 0.38"
Wall Fastener Installation

- Sealing washer to be compressed to manufacturer's recommended level
- Drive angle shall not exceed manufacturer's specified limit, or 15 degrees if no limit exists
- Penetrate wood framing to greater of 0.75" or 75% of specified embedment depth
- Fasteners missing a component necessary to proper sealing shall not be used
Scratches

• Aggregate length of all shallow scratches shall not exceed 0.5" per foot of panelized perimeter

• Aggregate length of all deep scratches shall not exceed .25" per foot of panelized perimeter
Scuffs and Scrapes

- Total area of all scuffs shall not exceed 0.02 in\(^2\) per foot of panelized perimeter
- Total area of all scrapes shall not exceed 0.005 in\(^2\) per foot
- No single scrape shall expose more than 0.1 in\(^2\) of underlying metal
Dents

• Total number of wall dents shall not exceed 1 per 100 ft
• 1.0" maximum dimension, 0.12" maximum depth
• If paint is cracked, panel must be replaced
Rib and Edge Kinks

- Rib kinks not allowed unless covered by another component or will not affect structural integrity

- Total edge kinks shall not exceed 1 per 100 ft
Cutting of Panels

• Outwardly visible panel edge shall not be field cut
• Metal chips from drilling or cutting shall be immediately removed from panel and trim
• Any metal panel or trim edge that will be visible after building completion shall not be cut with an abrasive blade
WHERE TO FIND THESE DOCUMENTS?
ACCURACY OF POST-FRAME BUILDING CONSTRUCTION

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Quality Assessment of Light-Gauge Metal Cladding and Trim Installation

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Metal Panel and Trim Installation Tolerances

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Supporting Resources

- **Post-Frame Construction Framing Tolerances**
  
  Accepted Practices for Post-Frame Building Construction: Framing Tolerances
  
  [Click Here](#) to access the Members Only Section to read this article.

- **Metal Panel and Trim Installation Tolerance**
  
  Accepted Practices for Post-Frame Building Construction: Metal Panel and Trim Installation Tolerances
  
  [Click Here](#) to access the Members Only Section to read this article.
An advantage of being a member of the NFBA!
CONCLUSION

ANY QUESTIONS?

EXPERIENCES WITH THE TOLERANCE DOCUMENTS OR RELATED ISSUES?
THANK YOU

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