



National Evaluation Service, Inc.

Participating Members:

BOCA Evaluation Services, Inc.

ICBO Evaluation Service, Inc.

SBCCI Public Safety
Testing and Evaluation Services, Inc.

4051 West Flossmoor Road
Country Club Hills, Illinois 60478-5795
(708) 799-2305

5360 Workman Mill Road
Whittier, California 90601-2299
(562) 699-0543

900 Montclair Road, Suite A
Birmingham, Alabama 35213-1206
(205) 591-1853

NATIONAL EVALUATION REPORT

Copyright © 1998, National Evaluation Service, Inc.

NER-392

Reissued February 1, 1998

FR-SYSTEM 1™, FR-SYSTEM 2™ AND FR SYSTEM 3™ FIRE-RESISTANCE-RATED FLOOR-CEILING AND ROOF-CEILING ASSEMBLIES WITH WOOD TRUSSES

ALPINE ENGINEERED PRODUCTS, INC.
1950 MARLEY DRIVE
HAINES CITY, FLORIDA 33844

1.0 SUBJECT

FR-SYSTEM 1™, FR-SYSTEM 2™ and FR-SYSTEM 3™,
Fire-resistance-rated Floor-Ceiling and Roof-Ceiling As-
semblies with Wood Trusses.

2.0 PROPERTY FOR WHICH EVALUATION IS SOUGHT

Fire Resistance.

3.0 DESCRIPTION

The FR-System floor-ceiling and roof-ceiling assemblies
have been tested in accordance with ASTM E 119. The as-
semblies are constructed of the following materials:

3.1 WOOD-BASED SHEATHING

Sheathing shall be APA-Rated Sheathing or Sturd-I-Floor
and shall be Exposure 1.

3.2 WOOD TRUSSES

Trusses shall be fabricated using nominal 2 x 3 or larger lum-
ber, oriented either horizontally (Figures 1a, 2a and 3a) or
vertically (Figures 1b, 2b and 3b). Truss members shall be
connected with Lumbermate Series T, Alpine, Alpine HS, or
Woodloc galvanized steel truss plates, minimum No. 20
gage (MSG) [0.036 inch (0.91 mm)], with $5/16$ -inch (7.9 mm),
or longer, teeth projecting perpendicular to the plane of the
plate. Truss bottom chord splices shall be connected with
Lumbermate Series K or Alpine No. 16 [0.058 inch (1.47
mm)] galvanized steel truss plates, minimum No. 16 MSG
[0.058 inch (1.47 mm)]. Additionally, truss plates shall have
a current National Evaluation Service, Inc., report or applica-
ble BOCA ES, ICBO ES or SBCCI PST & ESI evaluation re-
port. Truss designs for parallel-chord and sloped trusses
used in these assemblies shall be approved by the building
official.

3.3 WALLBOARD EDGE BLOCKING

FR-Quik Channel Sets™ and Bond Washers™ (Figures 4a
and 4b) are manufactured by Lumbermate Division using
minimum No. 28 MSG [0.016 inch (0.41 mm)] galvanized
steel with minimum 33,000 psi (227 MPa) yield strength.
Channels are $1\frac{1}{4}$ inches (31.7 mm) by $5/8$ inch (15.9 mm),
with sleeve ends permitting channels to move lengthwise.
Washers are $1\frac{1}{4}$ inches (31.7 mm) in diameter, with a center
hole formed to match the bugle-head drywall screws, and
with smaller holes surrounding the center hole for finish com-
pound adhesion to the wallboard.

3.4 INSULATION

Insulation, as permitted in Section 4.0 of this report, shall be
glass fiber or rock wool. Flame-spread rating shall be 25 or
less when tested in accordance with ASTM E 84.

3.5 VAPOR BARRIER

A vapor barrier, such as polyethylene film or foil-back gyp-
sum wallboard, is permitted to be added to any assembly.

3.6 GYPSUM WALLBOARD

Gypsum wallboard shall be identified as meeting ASTM C
36.

4.0 INSTALLATION

4.1 GENERAL

The manufacturer's published installation instructions and
this report shall be adhered to and a copy of these instruc-
tions and this evaluation report shall be available on the job-
site at all times during the installation. This evaluation report
shall govern over the manufacturer's published installation
instructions.

4.2 FIRE-RESISTANCE-RATED ASSEMBLIES

The following assemblies have been tested in accordance
with ASTM E 119 and are classified as follows:

4.2.1 One-hour Fire-resistance-rated Floor-ceiling and Roof-ceiling Assembly. Finish Rating: 23 Minutes. FR-SYSTEM 1™

4.2.1.1 Subfloor and Roof Sheathing: Sheathing shall
be minimum $23/32$ inch (18.3 mm) thick with tongue-and-

This report is limited to the specific product and data and test reports submitted by the applicant in its application requesting this report. No independent tests were performed by the National Evaluation Service (NES), and NES specifically does not make any warranty, either expressed or implied, as to any finding or other matter in this report or as to any product covered by this report. This disclaimer includes, but is not limited to, merchantability. This report is also subject to the limitation listed herein.

groove long edges. Long edges shall be installed perpendicular to trusses. AFG-01 construction adhesive shall be applied as $\frac{3}{8}$ -inch-diameter (9.5 mm) bead to the top chord of the trusses and the grooved edges of the panels. The sheathing is fastened to the truss chord using 6d deformed shank nails or 8d common nails, spaced 6 inches (152 mm) on center at panel ends and 10 inches (254 mm) on center in the field.

Alternately, with minimum $\frac{3}{4}$ -inch-thick (19.1 mm) lightweight concrete or floor topping mixture, sheathing is permitted to be minimum $\frac{19}{32}$ inch (15.1 mm) thick, if allowed by the finish floor manufacturer's specifications.

4.2.1.2 Wood Trusses: Trusses shall be spaced a maximum of 24 inches (610 mm) on center and shall have a minimum truss depth of 16 inches (406 mm).

4.2.1.3 Bracing: Bracing shall be minimum 2 x 6 nominal lumber, oriented vertically and installed perpendicular to trusses on maximum 10-foot (3048 mm) centers. Bracing shall be secured to each truss with three 16d nails.

4.2.1.4 Wallboard Edge Blocking: Adjacent ceiling wallboard edges perpendicular to trusses shall have FR-Quik Channel Sets centered lengthwise over the wallboard joints. The channels shall be secured to the trusses with one 1-inch-long Type S drywall screw at each end.

4.2.1.5 Gypsum Wallboard: Gypsum wallboard shall be attached to the bottom chords of the trusses with the long dimension perpendicular to trusses. The wallboards approved for use are $\frac{5}{8}$ -inch-thick (15.9 mm) Celotex Fi-Rok Plus, Georgia Pacific Fire Stop C, Gold Bond Fire-Shield G, and US Gypsum Firecode C, Type X gypsum wallboards. Wallboard end joints shall be staggered a minimum of 24 inches (610 mm). The wallboard shall be fastened directly to the trusses with $1\frac{5}{8}$ -inch-long (41.3 mm), Type S drywall screws on 8-inch (203 mm) centers, and shall be fastened to the FR-Quik channels with Bond Washers (Figure 4b) and 1-inch-long (25.4 mm), Type S screws spaced 8 inches (203 mm) on center, driven through the crease between adjacent wallboards.

4.2.1.6 Finish System: All joints shall be covered with paper tape embedded in cementitious compound, and exposed screw heads shall be covered with compound. As an alternative, nominal $\frac{3}{32}$ -inch-thick (2.38 mm) veneer plaster, complying with ASTM C 37, is permitted to be applied to the entire surface of the wallboard.

4.2.2 Two-hour Fire-resistance-rated Floor-ceiling and Roof-ceiling Assembly. Finish Rating: 65 minutes. FR-SYSTEM 2™

4.2.2.1 Subfloor and Roof Sheathing: Sheathing shall be minimum $\frac{23}{32}$ inch (18.3 mm) thick with tongue-and-groove long edges. Long edges shall be installed perpendicular to trusses. Construction adhesive, complying with the AFG-01 construction-adhesive standard, shall be applied as $\frac{3}{8}$ -inch-diameter (9.5 mm) bead to the top chord of the trusses and the grooved edges of the panels. The sheathing is fastened to the truss chords with 6d deformed shank nails or 8d common nails, spaced 6 inches (152 mm) on center at panel ends and 10 inches (254 mm) on center in the field. Underlayment sheathing shall be minimum $\frac{1}{4}$ inch thick (6.4 mm), and shall be installed with edges and ends staggered from the base layer sheathing in accordance with the applicable code.

In lieu of underlayment, minimum $\frac{3}{4}$ -inch-thick (19.1 mm) lightweight concrete or topping mixture is permitted to be substituted, in which case the base layer sheathing is per-

mitted to be minimum $\frac{19}{32}$ inch (15.1 mm) thick, if allowed by the finish floor manufacturer's specifications.

4.2.2.2 Wood Trusses: Trusses shall be spaced a maximum of 24 inches (610 mm) on center and shall have a minimum depth, including shield member, of 16 inches (406 mm). For horizontal orientation (Figure 2a) or vertical orientation, design depth of trusses shall be $1\frac{1}{2}$ inches (38 mm) less than overall depth of trusses, including shield member. A nominal 2-inch-thick (51 mm) continuous wood member, the same width as the truss, shall be attached to the truss assembly adjacent to, and under, the bottom chord by extending the truss plates a minimum of 1 inch (25.4 mm) onto the face of the wood member. The wood member acts as a shield, and is permitted to consist of several pieces.

4.2.2.3 Bracing: Bracing shall be minimum 2 x 6 nominal lumber oriented vertically and installed perpendicular to trusses on maximum 10-foot (3048 mm) centers. Bracing shall be attached to each truss with three 16d nails.

4.2.2.4 Insulation: Insulation, when used, shall be batts or rolls installed with stay wires located between the trusses and with the ends of the insulation located a minimum of $1\frac{1}{2}$ inches (38 mm) above the bottom face of the trusses, and the length of the insulation arched to a minimum 3 inches (76 mm) above the top of the wallboard.

4.2.2.5 Wallboard Edge Blocking: Adjacent base layer ceiling wallboard edges perpendicular to trusses shall have FR-Quik Channel Sets centered lengthwise over the wallboard joints. Blocking shall be secured to trusses with one 1-inch-long (25.4 mm), Type S drywall screw at each end.

4.2.2.6 Gypsum Wallboard: Two layers of $\frac{5}{8}$ -inch-thick (15.9 mm) Celotex Fi-Rok Plus, Georgia Pacific Fire Stop C, Gold Bond Fire-Shield G, or US Gypsum Firecode C, Type X gypsum wallboard shall be installed with long dimensions perpendicular to trusses and staggered between base layer and finish layer. End joints shall be on the centerline of truss chords, and all joints shall be staggered between the base layer and finish layer minimum 24 inches (620 mm). The base layer shall be fastened directly to the bottom chord of the truss with minimum $2\frac{5}{8}$ -inch-long (67 mm), Type S drywall screws with Bond Washers at 12 inches (305 mm) on center. The base layer is fastened to channel sets with Type S, 1-inch-long (25.4 mm) screws with Bond Washers on 8-inch (203 mm) centers driven through the crease between adjacent wallboards. The finish layer shall be fastened to trusses with $2\frac{1}{4}$ -inch-long (57 mm), Type X drywall screws on 8-inch (203 mm) centers, and with $1\frac{1}{4}$ -inch (31.7 mm) Type G screws 12 inches (305 mm) back from end joints at 12 inches (305 mm) on center.

An alternative installation using resilient channels consists of two layers of $\frac{5}{8}$ -inch-thick (15.9 mm) Celotex Fi-Rok Plus, Georgia Pacific Fire Stop C, Gold Bond Fire-Shield G, or US Gypsum Firecode C, Type X gypsum wallboard. The base layer shall be installed with the long dimension perpendicular to trusses. End joints shall occur on centerline of truss chords and shall be staggered. The base layer shall be attached directly to trusses with minimum $2\frac{5}{8}$ -inch-long (67 mm), Type S drywall screws spaced 12 inches (305 mm) on center. The base layer is attached to FR-Quik Channel sets with Bond Washers and Type S, 1-inch-long (25.4 mm) screws on 8-inch (203 mm) centers, driven through the crease between adjacent wallboard panels. Resilient channels formed from No. 25 [0.021 inch (0.53 mm)] MSG galvanized steel, spaced 24 inches (610 mm) on center, installed perpendicular to trusses and overlapped $1\frac{1}{2}$ inches (38 mm) at splices, are fastened to each truss with an 8d nail or a Type S, $1\frac{5}{8}$ -inch-long (41.3 mm) screw. Minimum clearance of channels to walls shall be $\frac{3}{4}$ inch (19.1 mm). Additional pieces 60 inches (1524 mm) long shall be placed im-

mediately adjacent to end joints of finish layer wallboard and shall extend 6 inches (152 mm) beyond each edge of the wallboard. Finish layer wallboard long dimensions shall be perpendicular to channels. End joints shall be staggered. The finish layer is fastened directly to the channels with Type S, 1-inch-long (25.4 mm) screws on 8-inch (203 mm) centers.

4.2.2.7 Finish System: All joints shall be covered with paper tape embedded in cementitious compound, and exposed screw heads shall be covered with compound. As an alternative, nominal $3/32$ -inch-thick (2.38 mm) veneer plaster, complying with ASTM C 37, is permitted to be applied to the entire surface of the wallboard.

4.2.3 One-hour Fire-resistance-rated Floor-ceiling and Roof-ceiling Assembly. Finish Rating: 44 minutes. FR-SYSTEM 3™

4.2.3.1 Subfloor and Roof Sheathing: Sheathing shall be minimum $15/32$ inch (11.9 mm) thick, with long edges installed perpendicular to trusses. Sheathing shall be attached with 6d deformed shank nails or 8d common nails spaced 6 inches (152 mm) on center at panel ends and 12 inches (305 mm) on center in the field.

4.2.3.2 Wood Trusses: Trusses shall be spaced a maximum of 24 inches (610 mm) on center. For parallel chord trusses, minimum depth shall be 15 inches (381 mm). For sloped trusses, slope shall be 3:12 or greater from each end, with central portion depth $19\frac{1}{2}$ inches (495 mm) or greater.

4.2.3.3 Bracing: Bracing members that are minimum 2 x 6 nominal lumber are oriented vertically and installed perpendicular to trusses on maximum 10-foot centers (3048 mm). The brace members are fastened to each truss with three 16d nails.

4.2.3.4 Insulation: Insulation is permitted in plenum area, and can include direct contact with upper face of wallboard.

4.2.3.5 Wallboard Edge Blocking: Adjacent base-layer ceiling-wallboard edges perpendicular to trusses shall have FR-Quik Channel Sets centered lengthwise over the wallboard joints. Blocking shall be fastened to trusses with one, 1-inch-long (25.4 mm), Type S drywall screw at each end.

4.2.3.6 Gypsum Wallboard: Two layers of $1/2$ -inch-thick (25.4 mm), Type X gypsum wallboard are installed with the long dimensions perpendicular to trusses and staggered between base layer and finish layer. End joints shall be located on centerline of truss chords, staggered in each layer and between base layer and finish layer minimum 24 inches (610 mm). The base layer shall be attached directly to trusses with $1\frac{5}{8}$ -inch-long (41.3 mm), Type S drywall screws with Bond Washers spaced 12 inches (305 mm) on center. The base layer is fastened to channel sets with Bond Washers and Type S, 1-inch-long (25.4 mm) screws on 8-inch (203 mm) centers, driven through the crease between adjacent wallboards. The finish layer shall be fastened to trusses with $2\frac{1}{4}$ -inch-long (57 mm) Type S drywall screws on 8-inch (203 mm) centers.

An alternative installation using resilient channels consists of two layers of $1/2$ -inch-thick (12.7 mm), Type X gypsum wallboard with the base layer installed with long dimensions perpendicular to trusses. End joints shall be located on centerline of truss chords and shall be staggered. The base layer is fastened directly to trusses with $1\frac{5}{8}$ -inch-long (41.3 mm) Type S drywall screws spaced 12 inches (305 mm) on center. The base layer is fastened to channel sets with Bond Washers and Type S, 1-inch-long (25.4 mm) screws on 8-inch (203 mm) centers, driven through the crease between adjacent wallboards. Resilient channels formed of No. 25

gage [0.021 inch (0.53 mm)] MSG galvanized steel, spaced on 24-inch (610 mm) centers perpendicular to trusses, overlapped at splices $1\frac{1}{2}$ inches (38 mm), are fastened to each truss with an 8d nail or a Type S, $1\frac{5}{8}$ -inch-long (41.3 mm) screw. Minimum clearance of channels to walls shall be $3/4$ inch (19.1 mm). Additional pieces 60 inches (1524 mm) long shall be placed immediately adjacent to end joints of the finish layer wallboard and shall extend 6 inches (152 mm) beyond each edge of the wallboard. Finish layer wallboard long dimensions shall be perpendicular to channels. End joints shall be staggered. The finish layer shall be attached directly to channels with Type S, 1-inch-long (25.4 mm) screws on 8-inch (203 mm) centers.

4.2.3.7 Finish System: All joints shall be covered with paper tape embedded in cementitious compound, and exposed screw heads shall be covered with compound. As an alternative, nominal $3/32$ -inch-thick (2.38 mm) veneer plaster, complying with ASTM C 37, is permitted to be applied to the entire surface of the wallboard.

5.0 IDENTIFICATION

The Lumbermate FR-Quik Channel Sets described in this report shall be identified by the name and address of the manufacturer as well as the name of the product.

6.0 EVIDENCE SUBMITTED

6.1 Manufacturer's descriptive literature and published installation guide.

6.2 PFS Corporation prepared report of floor-ceiling assembly one-hour fire-endurance test done in accordance with ASTM E 119, Report No. 85-141, signed by Kirk Grundahl, P.E., and Erwin L. Shaffer, P.E., dated May 19, 1986.

6.3 PFS Corporation prepared report of floor-ceiling and roof-ceiling assembly one-hour fire-endurance test done in accordance with ASTM E 119, Report No. 87-40, signed by Larry A. Beineke, Ph.D., and Michael J. Slifka, P.E., dated December 15, 1987.

6.4 PFS Corporation prepared report of roof-ceiling assembly two-hour fire-endurance test done in accordance with ASTM E 119, Report No. 88-02, written by Larry A. Beineke, Ph.D., and Michael J. Slifka, P.E., dated December 30, 1987.

6.5 PFS Corporation prepared letter discussing PFS tests, Reports No. 87-40, 88-02, and 88-03, signed by Larry A. Beineke, Ph.D., and Michael J. Slifka, P.E., dated May 3, 1988.

6.6 PFS Corporation prepared letter discussing PFS tests, Reports No. 87-40 and 85-141, signed by Ronald Reindl for Michael J. Slifka, P.E., dated July 15, 1988.

7.0 CONDITIONS OF USE

The National Evaluation Service Committee finds that the FR-Systems Fire-resistance-rated Assemblies described in this report comply with the requirements in the BOCA National Building Code/1996, the 1997 Standard Building Code, and the 1994 Uniform Building Code with 1996 Accumulative Supplement, subject to the following conditions:

7.1 FR-Systems shall be installed in accordance with this report and the manufacturer's instructions.

7.2 The scope of this report does not include the structural design of the floor-ceiling or roof-ceiling system. The structural system shall be designed in accordance with the applicable code.

7.3 Truss connector plates shall be as described in Section 3.2 of this report and shall be listed in a current National Evaluation Service report or applicable BOCA ES, ICBO ES or SBCCI PST & ESI evaluation report.

7.4 Insulation material shall not be used in fire-rated assemblies unless its performance as an element of a fire-rated assembly has been established by tests.

7.5 This report is subject to periodic re-examination. For information on the current status, consult the evaluation report listing or contact one of the participating members of the NES.

FR-SYSTEM 1

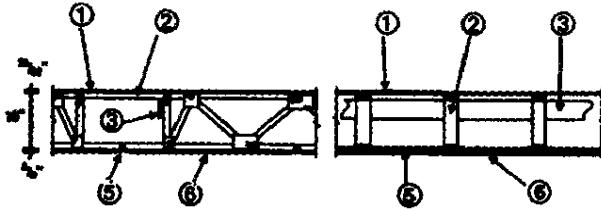


FIGURE 1a

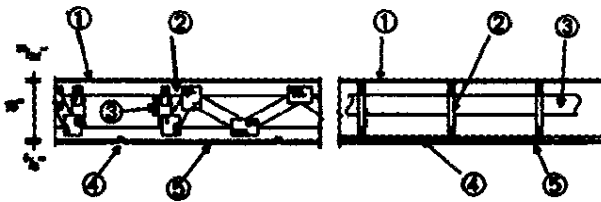


FIGURE 1b

FR-SYSTEM 3

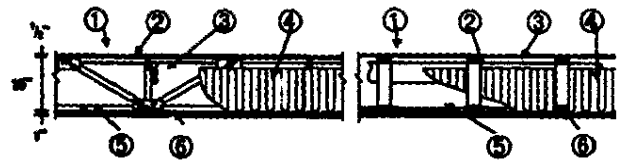


FIGURE 3a

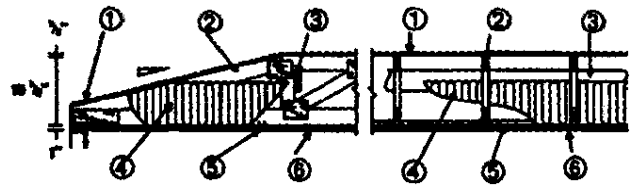


FIGURE 3b

FR-SYSTEM 2

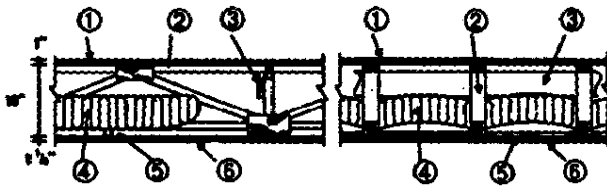


FIGURE 2a

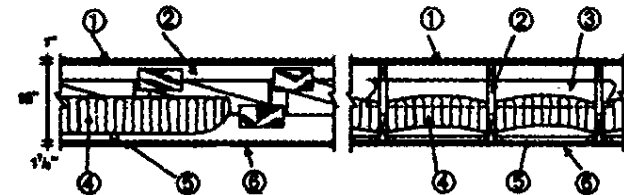


FIGURE 2b

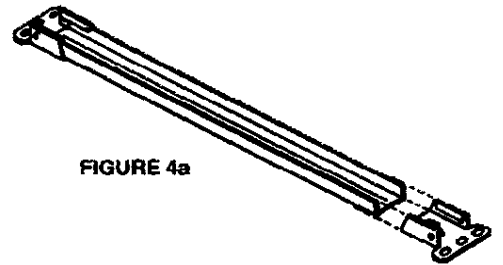


FIGURE 4a



FIGURE 4b

KEY	
1	Subfloor or Roof Sheathing
2	Truss or I-Beam
3	Bracing
4	Insulation
5	FR-Quik Channel Set
6	Gypsum Wallboard