

17.1 FIRE PERFORMANCE - INTRODUCTION

Fireproof buildings do not exist. Even buildings constructed entirely of noncombustible materials can suffer complete loss due to a fire started in the contents of the building. The intention of fire performance evaluation is to provide safe structures using reasonable and feasible measures, while taking into account a responsible risk cost benefit assessment. The general considerations of fire performance evaluation must include all the following: structural components, exterior and interior finish components, building contents, detection and alarm systems, exit design, fire protection system (sprinklers), protection from adjacent buildings or fire hazards, accessibility to fire-fighters, and the availability of fire-fighting services.

Some localities have established geographic fire zones restricting the type of use or occupancy and type of construction. The goal is to reduce fire risk where fire spread is likely due to the density of structures and where fire fighting would also be difficult. Most codes use occupancy classifications to aid in determining fire risk. Setbacks and space around buildings is an issue in the ability of fire fighters to reach a burning structure and to limit fire spread.

For materials used in construction two of the primary concerns are flame spread and fire resistance. Flame spread is a property of the material once fire has started and building codes generally include tables giving flame spread ratings. These ratings are measured by ASTM test E84. Fire resistance is the ability of a material or assembly of materials to resist penetration by fire or by heat transfer high enough to cause combustible material to be ignited on the other side of the assembly. The standard test for measuring fire resistance is ASTM test E119 and the time is given in hours or minutes.

Both passive and active measures can be taken to impede the spread of fire in a structure. Fireblocking, draftstopping, and fire tested assemblies are passive design methods. Where passive design methods do not meet the code requirements for protection of life and property, an active method is specified in the form of a fire protection system, usually a water or chemical delivery system. Almost all current building codes include some form of fireblocking, draftstopping, and fire separation requirements, as well as fire protection system implementation. Information regarding the

use of these measures are covered here only as general principles. One must look at the local governing code and the unique design requirements of the project for specific implementations of these items. The issues addressed in this section, although specifically related to wood truss usage, can apply generally to all types of mixed and light frame construction.

Finally, inasmuch as the fire performance of trusses continues to be an issue in the marketplace, WTCA has worked with the Houston Fire Department to develop an educational CD and web based educational program that takes a look at the truss industry from the fire service's perspective. For further information on this work, or if you have specific questions on fire endurance, visit our website at www.woodtruss.com or please contact WTCA.

17.2 FIREBLOCKING, DRAFTSTOPPING AND FIRE PROTECTION

Fireblocking and draftstopping are required by building codes to control fire and smoke spread in the concealed spaces of a building's structural components, such as floors, walls, and stairs. Control prevents spread of a fire by restricting movement of flame, gases and smoke that accompany a fire. Control is desirable in all buildings regardless of whether a building or its components are classified as noncombustible, since combustibility of a building's structural components is often not a major factor in fire spread.

Fireblocking is required in both vertical and horizontal orientations, like stud spaces at 10" intervals and at ceiling and floor levels to prevent spread of fire in the vertical direction and by solid blocking of floor joists over points of support and in some cases at partitions and at soffits and dropped ceilings and similar locations to prevent spread in the horizontal direction.

Draftstopping is usually provided by requiring a plywood or gypsum board barrier at 3,000 ftsq intervals in attic spaces. A horizontal area of 1,000 ft sq between draftstops is a typical requirement in non-residential buildings in floors. Multi-family buildings generally require draftstopping in line with the dwelling units and tenant separations. The more constrictive floor requirement is based on the rationale that the integrity of a floor is more critical than that of a roof and, therefore, open areas should be smaller in floor spaces than in attics.

FIRE PERFORMANCE OF TRUSSES

The open areas between suspended ceiling and floor-ceiling assemblies and the open space created by floor trusses only require following draftstopping and fireblocking continuity through the space. No other special provisions are currently required.

American Forest and Paper Association (AF&PA) developed the following fireblocking and draftstopping illustrations. In all cases, specific building code requirements prevail.

Fireblocking in wood frame construction is illustrated in Figures 17.2.1 - 17.2.8. Generally, fireblocking shall consist of 2" nominal lumber with broken lap joints or one thickness of 3/4" plywood with joints backed by 3/4" plywood, or other approved materials.

Figures 17.2.1 & 2
Fireblocking in
concealed spaces of
stud walls and
partitions, including
furred spaces, at the
ceiling and floor levels.

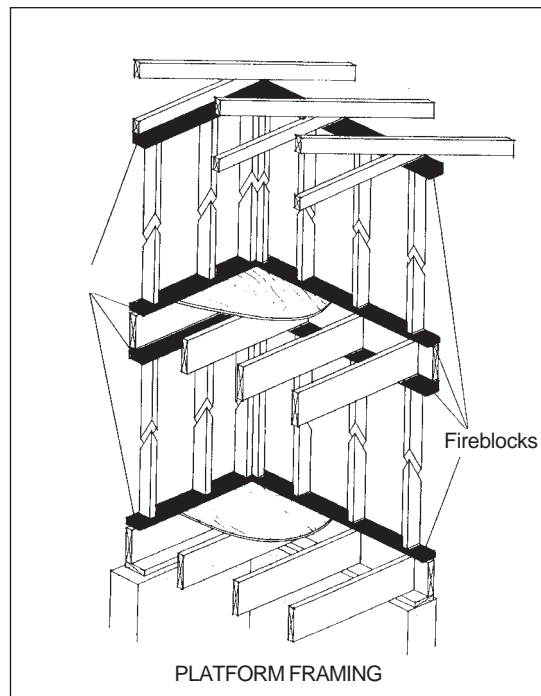


Figure 17.2.1

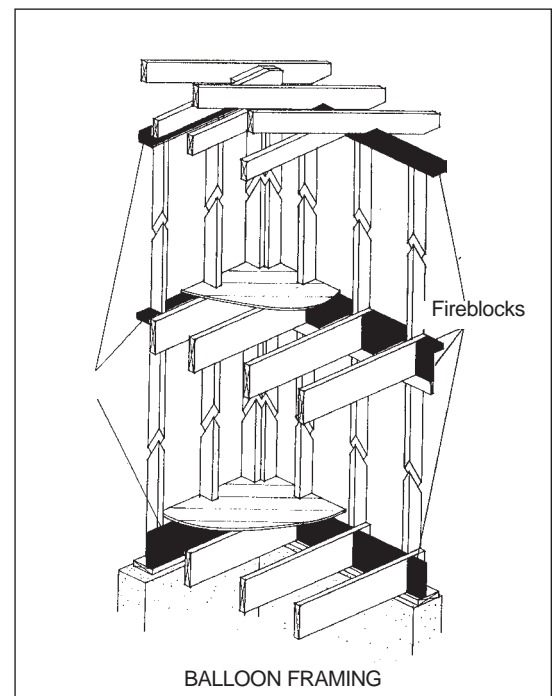


Figure 17.2.2

Figures 17.2.3 - 5
Fireblocking is applied
at all interconnections
between concealed
vertical and horizontal
spaces, such as in
soffits (Figure 17.2.3),
drop ceilings (Figure
17.2.4), and cove
ceilings (Figure
17.2.5).

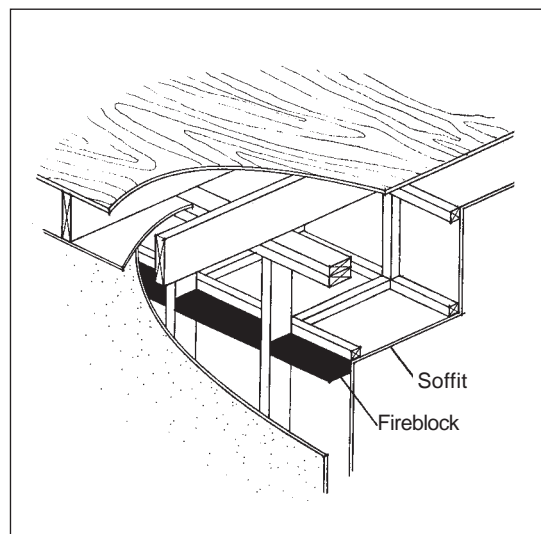


Figure 17.2.3

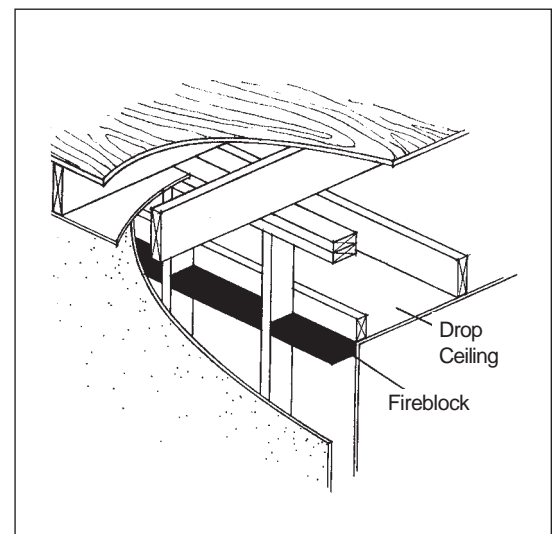


Figure 17.2.4

FIRE PERFORMANCE OF TRUSSES

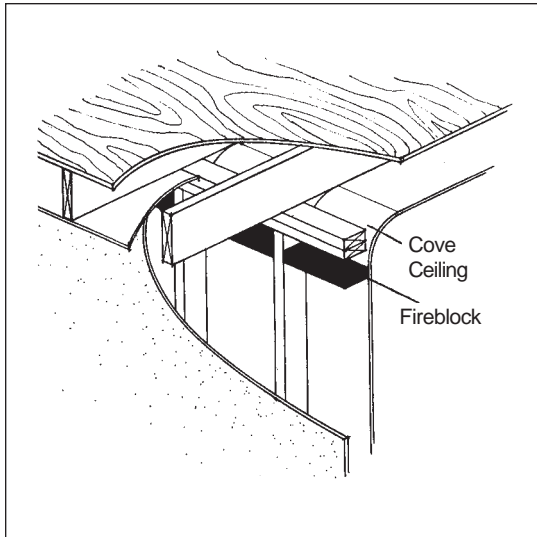


Figure 17.2.5

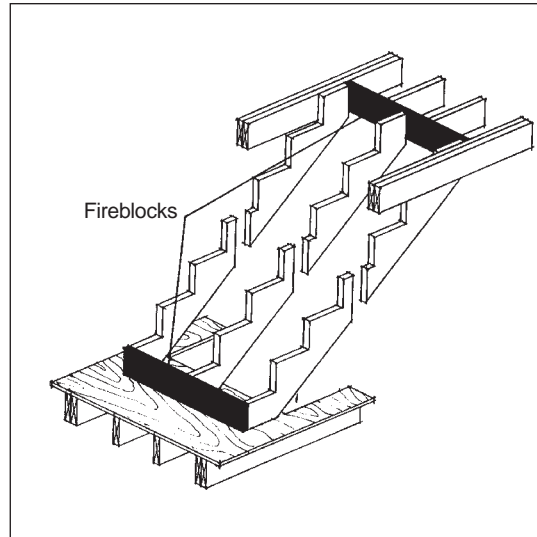


Figure 17.2.6

Figure 17.2.6
Fireblocking in
concealed spaces
between stair stringers
at the top and bottom
of the run.

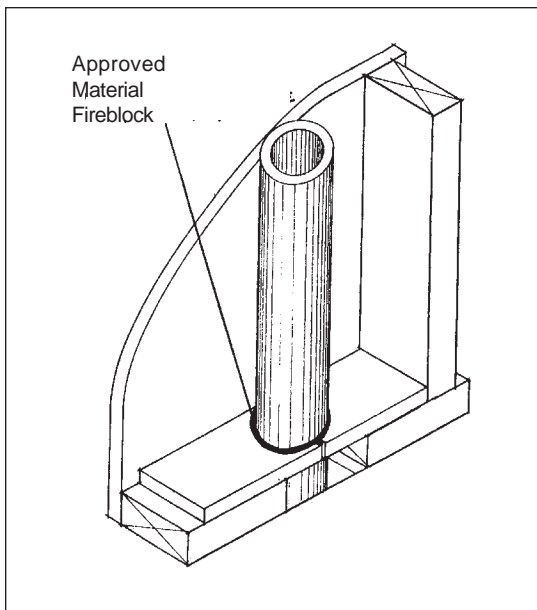


Figure 17.2.7

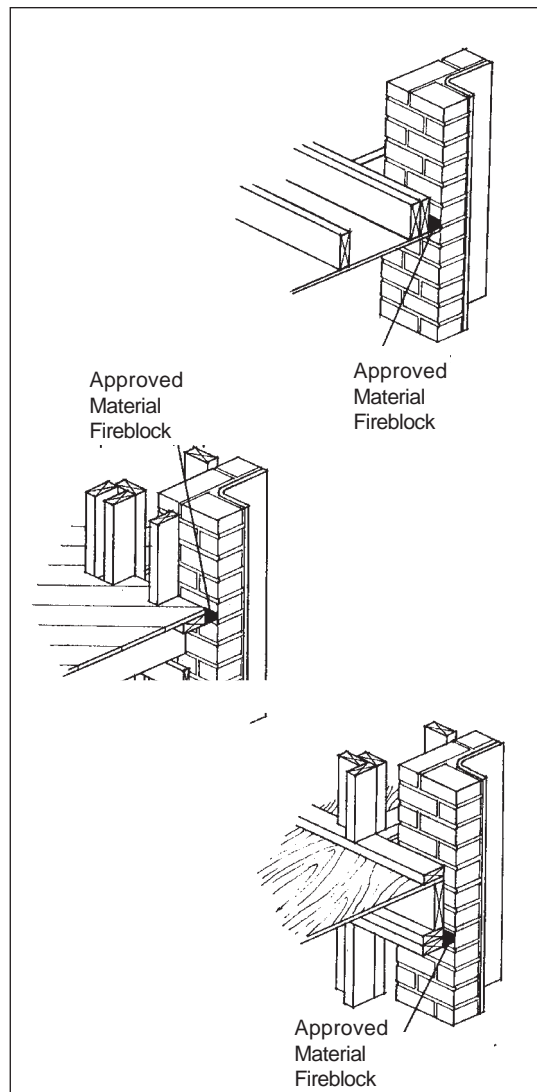


Figure 17.2.8

Figures 17.2.7 & 8
Fireblocking with
noncombustible
materials at openings
around vents, pipes,
ducts, chimneys, and
fireplaces at ceiling
and floor levels.

FIRE PERFORMANCE OF TRUSSES

Draftstopping in floor-ceiling assemblies is shown in Figures 17.2.9 - 17.2.11. In buildings other than one- and two-family dwellings, draftstopping is placed in floor-ceiling assemblies so that horizontal areas do not exceed 1,000 ft sq.

Draftstopping is required in multi-family dwellings, motels, and hotels in the attic, mansard, overhang, or other concealed roof spaces above, and in line with, the tenant separation when tenant separation walls do not extend to the roof sheathing above (Figure 17.2.12). It is not, however, required in the attics of single-family dwellings. Draftstopping for multi-family dwellings, motels and hotels is not required where approved sprinklers are provided. In addition, where corridor walls provide a tenant separation, draftstopping is generally required above only one of the corridor walls.

Figures 17.2.9 & 10
Draftstopping in the floor-ceiling assemblies of one- and two-family dwellings where usable spaces are separated into two or more approximately equal areas no greater than 500 ft sq. In these cases, draftstopping shall be provided parallel to the main framing members.

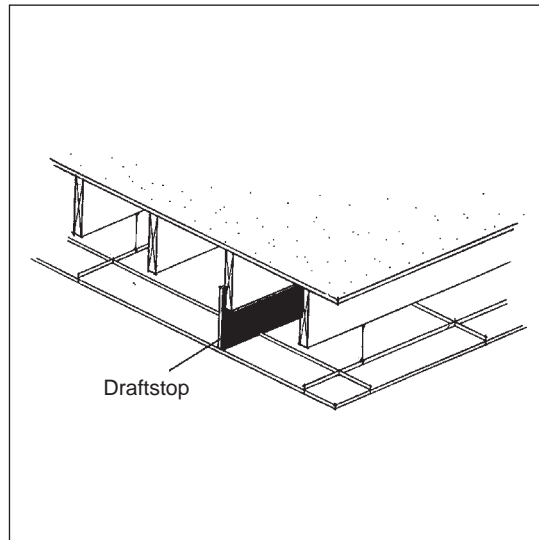


Figure 17.2.9

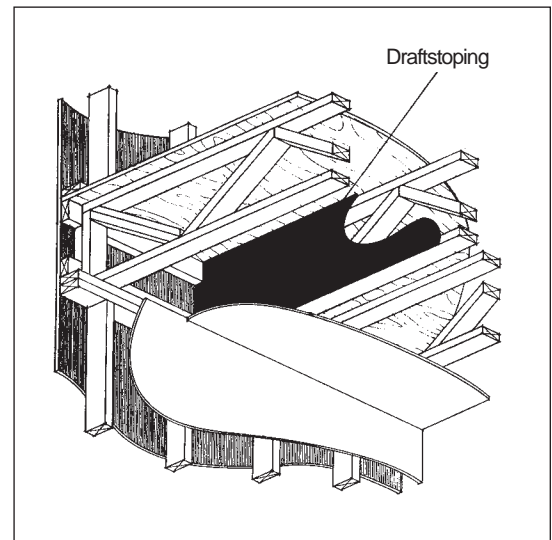


Figure 17.2.10

Figure 17.2.11
Draftstopping for multi-family dwellings, motels, and hotels with floor-ceiling assemblies above and in line with the tenant separation, and tenant separation walls that do not extend to the floor sheathing above.

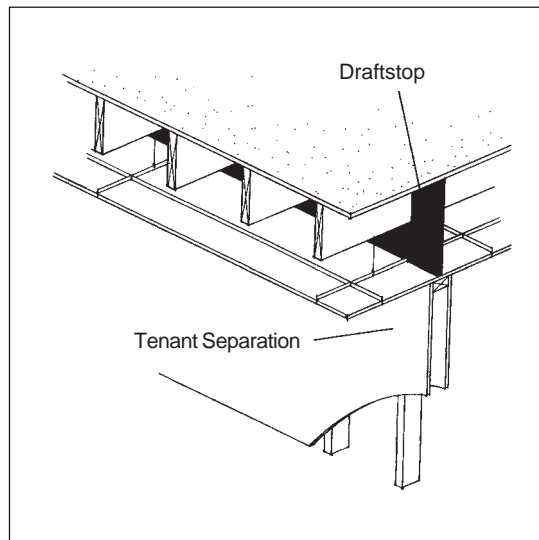


Figure 17.2.11

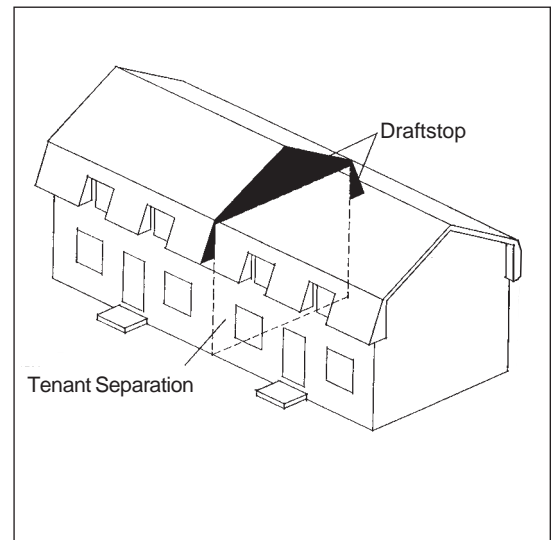


Figure 17.2.12

Figure 17.2.12
Draftstopping in multi-family dwellings, motels, and hotels.

17.3 ONE-HOUR AND TWO-HOUR RATED AREA SEPARATION ASSEMBLIES

It is of great concern when fire-rated assemblies are designed and specified without consideration of sound structural principles. Should a fire develop, these structural inadequacies could cause the assemblies to fail unexpectedly, increasing the risk of loss of life. The figures in this section provide sound structural and fire endurance details that maintain rated area separation assemblies.

Figure 17.3.1 shows several possible assemblies that can be used to make up a one-hour rated system for separation between occupancies for, a) floor trusses parallel to the wall assembly; and b) perpendicular to the wall assembly. A 2x4 fireblock is used between the walls next to the wall top plates. This effectively prevents the spread of fire inside the wall cavity. A minimum 1/2" gypsum wallboard attached to one side of the floor truss system, and located between the floor trusses, also provides a draftstop and fire protection barrier between occupancy spaces if a fire starts in the floor truss concealed space, which is a rare occurrence. The tenant separation in the roof is maintained through the use of a 1/2" gypsum wallboard draftstop attached to the ends of one side of the monopitch trusses and provided for the full truss height. This detail effectively provides one-hour compartmentation for all the occupied spaces using listed one-hour rated assemblies and the appropriate draftstops for the concealed spaces as prescribed by the model codes.

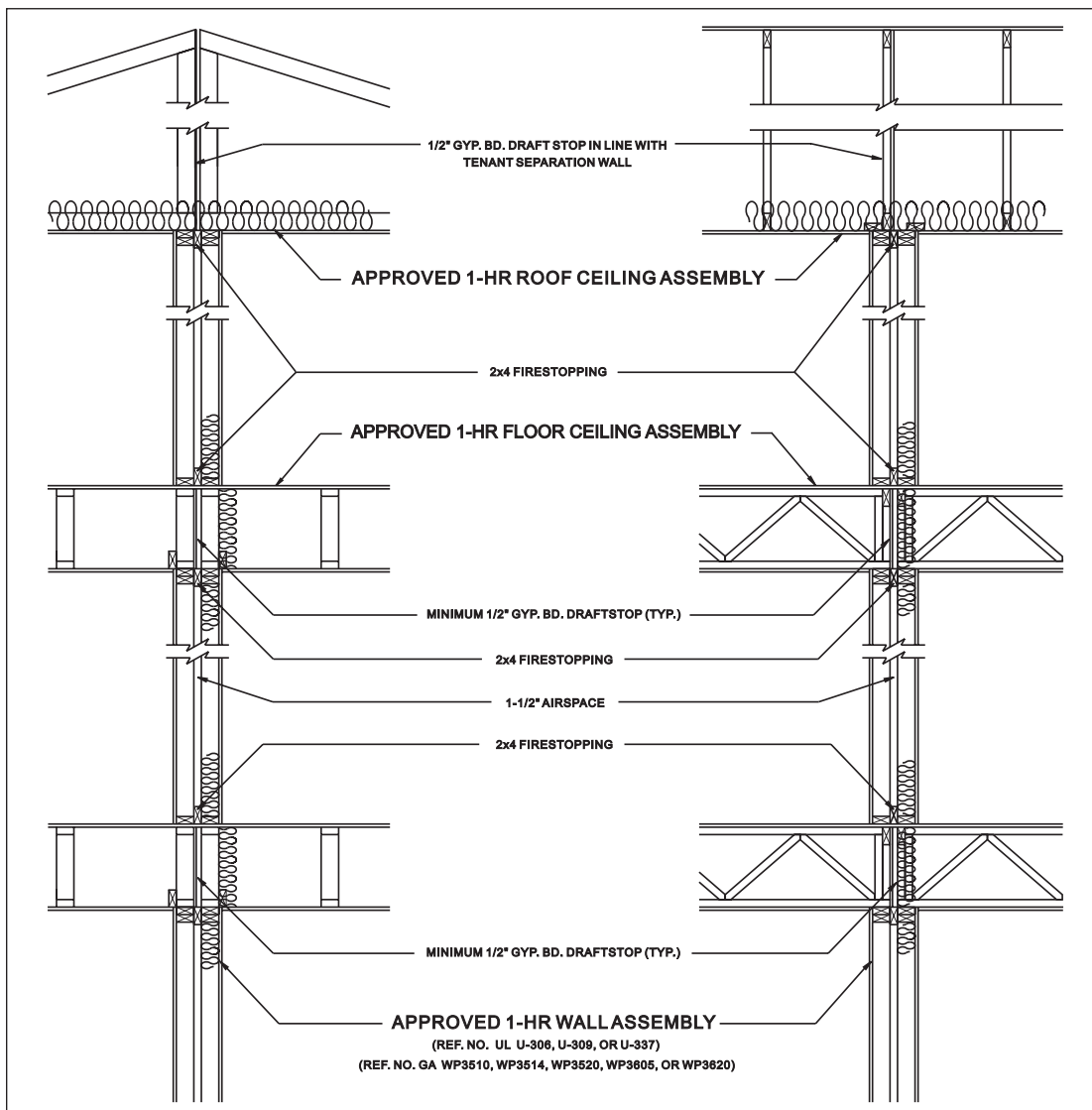


Figure 17.3.1
Assemblies that can be used to make up a one-hour rated system for separation between occupancies.

Figure 17.3.1

FIRE PERFORMANCE OF TRUSSES

Figure 17.3.2 shows an alternative roof detail to that in Figure 17.3.1 in which the roof trusses are parallel to the wall assembly. In this case, a single layer of 1/2" gypsum wallboard is attached to the side of a single roof truss in the location shown to provide the required draftstop and area separation.

Figure 17.3.2
Alternative roof
detail.

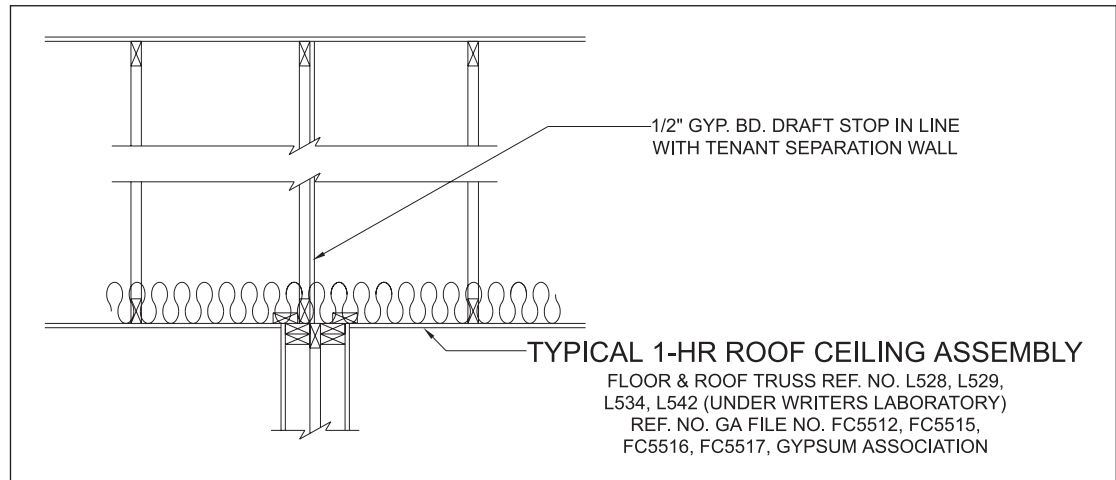
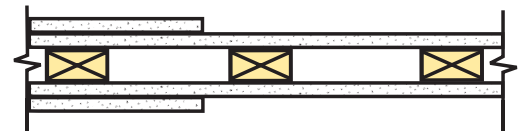


Figure 17.3.2

If a fire rated assembly, rather than draftstopping, is required within concealed attic spaces, the following details show approved one-hour and two-hour rated assemblies that may be used in the roof cavity and that may be constructed with gable end frames or trusses.

Figure 17.3.3
UL - U338

1 hour rated wall - bearing or non-bearing - with optional insulation, with a finish rating of 20 minutes for 1 layer of gypsum each side for non-bearing walls or 59 minutes with 2 layers of gypsum each side for bearing walls, on a single gable truss with 2x3 o.c. 2x4 studs spaced 24" o.c. max., effectively fireblocked.

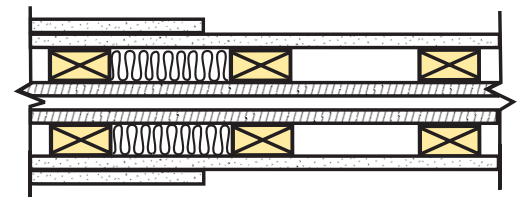


UL - U338

Figure 17.3.3

Figure 17.3.4
UL - U339

1 hour rated wall - bearing or non-bearing - with optional insulation, with a finish rating of 20 minutes for 1 layer of gypsum each side for non-bearing walls or 59 minutes with 2 layers of gypsum each side for bearing walls, on a double gable truss with 2x3 o.c. 2x4 studs spaced 24" o.c. max., effectively fireblocked. The septum sheathed with plywood or mineral/fiber board is optional in the bearing configuration.



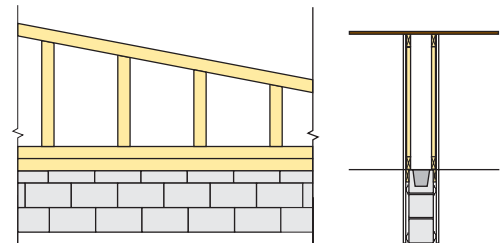
UL - U339

Figure 17.3.4

Figure 17.3.5
UL - L554

2 hour rated load wall with optional insulation, no finish rating given, with 2 carrying parallel chord trusses spaced 6-3/8" apart and webbing spaced 16" o.c. vertically, with one layer of 5/8" gypsum board one side each truss and either 15/32" or 19/32" sheathing on roof carried on a 2 hour rated concrete block wall.

(Note that the UL drawing is not clear as to the exact installation details)



UL - L554

Figure 17.3.5

THE CRITICAL ASPECTS FOR FIRE ENDURANCE ASSEMBLIES INCLUDE:

- ◆ Ensuring that the wall and ceiling assemblies of the room use one-hour rated assemblies. These are independent assemblies. The wall assembly does not have to be continuous from the floor to the roof to meet the intent of the code or the fire endurance performance of the structure. The intent of the code is that the building be broken into compartments to contain a fire to a given area. Fire resistance assemblies are tested to provide code-complying fire endurance to meet the intent of the code. The foregoing details meet the intent of the code.
- ◆ Properly fastening the gypsum wallboard to the wall studs and trusses. This is critical for achieving the desired fire performance from a UL or Gypsum Association assembly.
- ◆ Ensuring that the detail being used is structurally sound, particularly the bearing details. All connection details are critical to assembly performance. When a fire begins, if the structural detail is poor, the system will fail at the poor connection detail earlier than expected.
- ◆ Accommodating both sound structural details with appropriate fire endurance details. Since all conceivable field conditions have not been and cannot be tested, rational engineering judgment needs to be used.

The foregoing principles could also be applied to structures requiring two-hour rated area separation assemblies. In this case, acceptable two-hour wall assemblies would be used in conjunction with the two-hour floor-ceiling and roof-ceiling fire endurance assemblies detailed in pages 17-48 through 17-54. Typical two-hour wall assemblies include: Ref. No. U301, U334 or U342 (UL) and Ref. GA File Nos.: WP3810, WP3820, WP3910 or WP4135 (Gypsum Association).

17.4 THROUGH-PENETRATION FIRESTOPS

With all fire endurance assemblies, there is a need for penetrations through the assembly for plumbing, ventilation, electrical and communications purposes. These penetrations are allowed by code. For example, based upon the International Building Code, Section 711, the following penetrations are allowed in fire endurance rated assemblies:

- ◆ Membrane penetrations by steel, ferrous or copper conduits, electrical outlet boxes, pipes, tubes, vents, concrete, or masonry penetrating items where the annular space is protected to prevent the free passage of flame and the products of combustion. Such penetrations shall not exceed an aggregate area of 100 sq in. (64,500 mm sq) in any 100 sq ft (9.3 sq m) of ceiling area in assemblies tested without penetrations.
- ◆ Membrane penetrations by steel, ferrous or copper conduits, electrical outlet boxes, pipes, tubes, vents, concrete, or masonry penetrating items where the annular space is protected in accordance with an approved through-penetration firestop system installed and tested in accordance with ASTM E814 *Standard Method of Fire Tests of Through-Penetration Fire Stops*. The system shall have an F rating and a T rating of not less than 1 hour but not less than the required rating of the floor penetrated.

This means that as long as any penetration is protected by non-combustible insulation or caulking penetrations are allowed to be put into a fire endurance assembly where the aggregate area is 100 square inches in any 100 sq ft. Additionally penetrations of a membrane can be made through the use of ASTM E814 tested penetrations.

ASTM E814 uses fire-resistive assemblies (rated per ASTM E119) and penetrates them with cables, pipes, and ducts, etc., before subjecting the assembly to ASTM E119's fire endurance tests. Despite the penetrations, firestop assemblies tested according to ASTM E814 must not significantly lose their fire containment properties in order to be considered acceptable. Properties are measured according to the passage of any heat, flame, hot gases, or combustion through the firestop to the test assembly's unexposed surface.

Upon successful completion of fire endurance tests, firestop systems are given F&T ratings. These ratings are expressed in terms of hours, in much the same fashion as fire-resistive barriers.

- ◆ To obtain an F-Rating, a firestop must remain in the opening during the fire and hose stream test, withstanding the fire test for a prescribed rating period without permitting the passage of flame on any element of its unexposed side. During the hose stream test, a firestop must not develop any opening that would permit a projection of water from the stream beyond the unexposed side.
- ◆ To obtain a T-Rating, a firestop must meet the requirements of the F-Rating. In addition, the firestop must prevent the transmission of heat during the prescribed rating period that would increase the temperature of any thermocouple on its unexposed surface, or any penetrating items, by more than 325° F.

The UL Fire Resistance Directory lists literally thousands of tested systems. They have organized the systems with an alpha-alpha-numeric identification number. The first alpha is either a F, W, or C. These letters signify the type of assembly being penetrated: F signifies a floor, W signifies a wall, C signifies a ceiling. The second alpha signifies a limiting description, for example: C signifies a framed floor, L signifies a framed wall. The numeric portion is also significant: 0000-0999 signifies no penetrating items, 1000-1999 signifies metallic pipe, 2000-2999 signifies nonmetallic pipe, 3000-3999 signifies electrical cable, 4000-4999 signifies cable trays, 5000-5999 signifies insulated pipes, 6000-6999 signifies miscellaneous electrical penetrants, 7000-7999 signifies miscellaneous mechanical penetrants, 8000-8999 signifies a combination of penetrants.

For example, a floor/ceiling penetrated by a metallic pipe would have a designation of F-C-1xxx, or with nonmetallic pipe would be designated F-C-2xxx. A few examples of floor/ceiling penetrations are included here. Examples are from the UL Fire Resistance Directory, Vol. II: UL Systems F-C-2008, F-C-1006, F-C-3007 & 8, F-C-5002 (Figures 17.4.1-17.4.4).

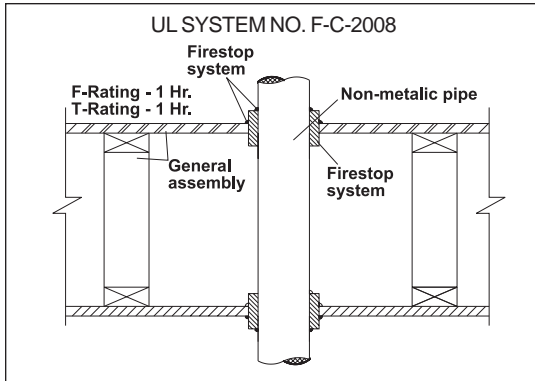


Figure 17.4.1

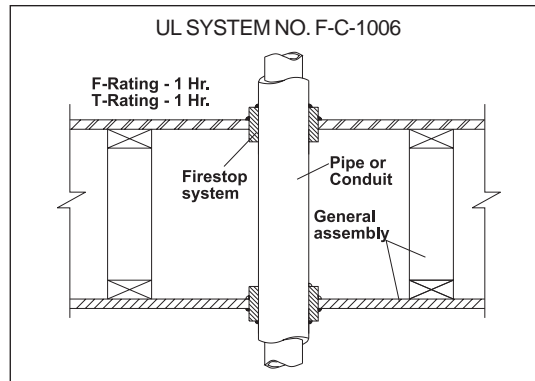


Figure 17.4.2

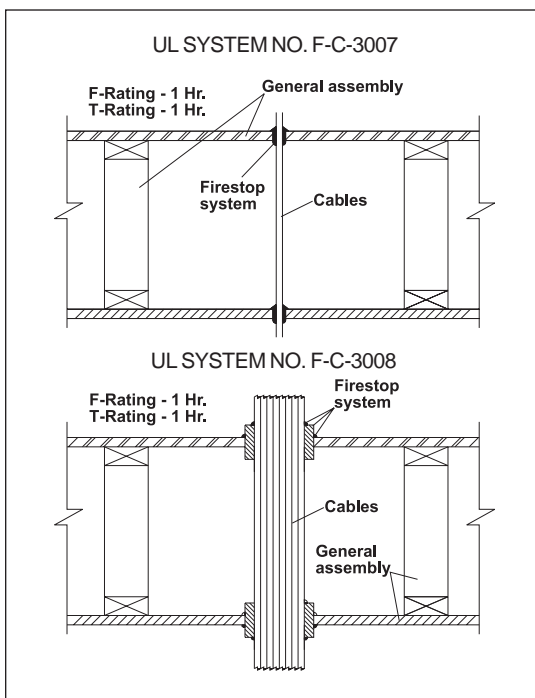


Figure 17.4.3

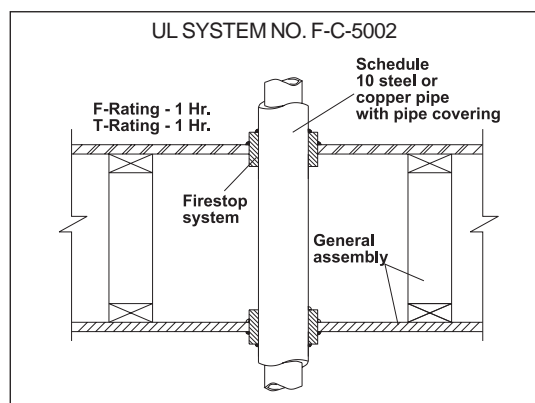


Figure 17.4.4

Figures 17.4.1-4 Floor/ceiling penetrations from the UL Fire Resistance Directory.

17.5 FIRE ENDURANCE WOOD TRUSS ASSEMBLIES

In the late 1970s, TPI and WTCA recognized the need for having industry-wide fire endurance assemblies that included trusses as the primary structural component. As the truss industry grew and expanded into commercial construction, the need for code-complying fire endurance assemblies became readily apparent. Generally, a fire endurance rating of one hour is mandated by code for many of the applications where trusses could be used. All testing on these assemblies is performed in accordance with the American Society of Testing & Materials' *Standard Methods for Fire Tests of Building Construction and Materials* (ASTM E119).

The truss industry has conducted a substantial amount of testing in the fire endurance assembly area. TPI is to be commended for the initiative it has taken to provide both broad-based fire endurance assemblies and fire endurance penetration tests. This has allowed, and will continue to allow, truss manufacturers to market their products in applications where fire rated assemblies are mandated by code.

On July 6, 1978, TPI successfully tested a truss assembly that utilized two layers of 1/2" Type X gypsum wallboard (FC-214). In 1981, TPI tested a single layer of 5/8" Type C gypsum wallboard attached to resilient furring channels (L529). In cooperation with WTCA, TPI in 1986 tested an assembly using a single layer of 5/8" Type C gypsum wallboard directly applied to the bottom chord of trusses with wood back blocking behind the gypsum joints (FC-392). Each of these assemblies passed the one-hour criterion set forth by the building codes.

The primary source documents for fire endurance assemblies are the *Fire Resistance Design Manual*, published by the Gypsum Association, and the *Fire Resistance Directory*, published by Underwriters Laboratory, Inc. (UL). These tested assemblies are available for specification by architects or Building Designers, and for use by all Truss Manufacturers where a rated assembly is required, and can generally be applied to both floor and roof assembly applications. Always check sources for latest versions of assembly listings.

According to the *Fire Resistance Design Manual*, GA-600-2000: "Specified floor-ceiling and roof-ceiling framing sizes or truss dimensions are minimums. Greater joist or truss sizes (depths) shall be permitted to be used in metal- or wood-framed systems. Indicated joist and truss spacings are maximums." Thus, larger and deeper trusses can be used under the auspices of the same design number. This approach has often been applied to roof truss applications since roof trusses are usually much deeper than the tested assemblies.

Several truss plate manufacturers have developed proprietary assemblies. These assemblies apply specifically to that truss plate manufacturer's truss plate and fire endurance assembly system. For more detailed information on these assemblies, the individual truss plate manufacturer should be contacted. For information on contacting these manufacturers, contact WTCA. NER-399 was donated for use by the truss industry by Weyerhaeuser Company.

LISTING OF FIRE ENDURANCE ASSEMBLY DESIGN NAMES AND NUMBERS

45 MINUTES	PAGE	FIGURE
FR-SYSYSTEM 4 TM	12	17.5.1
Truswal - 45-02	13	17.5.2
Truswal - 45-04	14	17.5.3
60 MINUTES		
GA - FC5512	15	17.5.4
UL - L542	16	17.5.5
GA - FC5515	17	17.5.6
GA - FC5516	18	17.5.7
UL - L528 & L534	19	17.5.8
TPI/WTCAFC-392	20	17.5.9
GA - FC5517	21	17.5.10
NER-392, FR-SYSTEM 1 TM	22	17.5.11
NER-392, FR-SYSTEM 3 TM	23, 24	17.5.12
Truswal - 60-02	25	17.5.13
Truswal - 60-06	26	17.5.14
Truswal - 60-10	27	17.5.15
FR-SYSTEM 5 TM	28	17.5.16
NER-399	29 - 31	17.5.17
UL - L546	32, 33	17.5.18
UL - L550	34 - 36	17.5.19
UL - L558	37, 38	17.5.20
UL - P522	39, 40	17.5.21
UL - P531	41, 42	17.5.22
Truswal 60-08	43	17.5.23
Truswal 60-04	44	17.5.24
UL - L529	45, 46	17.5.25
90 MINUTES		
Truswal 90 - 02	47	17.5.26
120 MINUTES		
Calculated Assembly	48, 49	17.5.27
UL - L556	50, 51	17.5.28
NER-392, FR-SYSTEM 2 TM	52, 53	17.5.29
FR-SYSTEM 6 TM	54	17.5.30

FIRE PERFORMANCE OF TRUSSES

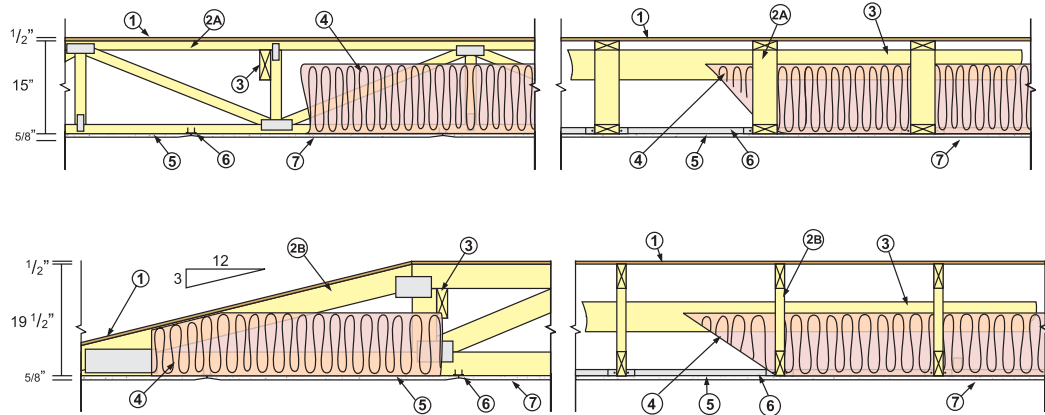
FR-SYSTEM4™

(Source: NER 392, 1991)

SPECIFICATIONS

Fire Rating: 45 minutes

Finish Rating: 22 minutes



1. Subfloor and Roof Sheathing: Sheathing shall be minimum 15/32" thick. Long edges are installed perpendicular to trusses. Nail with 6d deformed shank nails or 8d common nails spaced on 6" centers on panel ends and on 12" centers in the field.
2. Wood Trusses: Trusses shall be spaced a maximum of 24" on center. For parallel chord trusses, overall depth shall be 15" or greater. For sloped trusses, slope shall be 3/12 or greater from each end with central portion depth 19-1/2" or greater. Trusses should be fabricated using normal 2x4 or larger lumber oriented either horizontally or vertically. Truss members shall be secured with Lumbermate Series T, Alpine, Alpine HS, or Woodloc galvanized steel truss plates, minimum No. 20 Manufacturer's Standard Gage (MSG) with minimum 5/16" or longer teeth projecting perpendicular to the plane of the plate. Truss bottom chord splices shall be secured with Lumbermate Series K or Alpine No. 16 galvanized steel truss plates, minimum No. 16 MSG. Truss plates shall have a current National Evaluation Services Report or applicable model code evaluation report. Truss designs for trusses used in these assemblies shall be approved by Alpine Engineered Products, Inc.
3. Bracing: Minimum 2x6 nominal lumber oriented vertically and installed perpendicular to trusses on maximum 10' centers. Secure to each truss with three 12d nails.
4. Insulation: Insulation shall be glass fiber batts or rock wool. Flame spread rating shall be 25 or less. Insulation may be used in the plenum area including direct contact with upper face of wallboard.
5. Vapor Barrier: A vapor barrier such as polyethylene film or foil back gypsum wallboard may be added to any assembly.
6. Wallboard Edge Blocking: Adjacent ceiling wallboard edges perpendicular to the trusses shall have FR-Quik Channel Sets(tm) centered lengthwise over the wallboard joints. Secure to trusses with one Type S, 1" long screw each end.

FR-Quik Channel Sets™ and Bond Washers™ are manufactured by Alpine Engineered Products, Inc., using minimum No. 28 gage MSG galvanized steel with minimum 33,000 psi yield strength. Channels are 1-1/4" by 5/8" with sleeve ends permitting channels to move lengthwise. Washers are 1-1/4" in diameter, with a center hole formed to match bugle-head drywall screws, and surrounding holes for finish compound adhesion to the wallboard.
7. Gypsum Wallboard: Gypsum wallboard shall be one layer of 5/8" thick celotex Fi Rok Plus, Georgia Pacific Fire Stop C, Gold Bond Five Shield G, or, USG Firecode C, Type X. Long dimensions are trusses with Type S, 1-5/8" long screws on 8" centers. Secure to channel sets with Bond Washers and Type S, 2" long screws on 8" centers between adjacent wallboards.
8. Finish System (not shown): Paper tape embedded in joint compound over joints of finished layer with edges of compound feathered out and exposed screw heads covered with compound. As an alternate, nominal 3/32" thick veneer plaster may be applied to the entire surface of the wallboard.

Figure 17.5.1

DESIGN NO. TSC/FCA45-02

(Source: Intertek Testing Services, 2001 Directory of Listed Products)

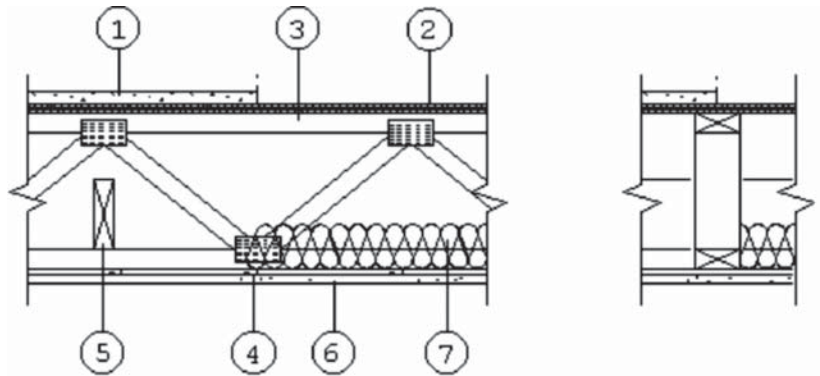
SPECIFICATIONS

Fire Rating: 45 minutes

Finish Rating: - 22 minutes

STC 50 with Insulation and Resilient Channels

STC 57 with 1-1/2" Lightweight Concrete



1. Topping (Optional) - Subject to design and project limitations, these systems may be augmented with a lightweight floor topping mix containing perlite or vermiculite aggregate.
2. Flooring - minimum 3/4" or 19.0 mm plywood or O-2 grade waferboard or strandboard.
3. Structural Member - Truswal metal truss plates with structural graded chords and webs as per NLGA grading rules and having a minimum depth of 10" and spaced up to a maximum of 24" o.c. for floor/ceiling systems. All FlorTrusses are to be designed and sealed by a Professional Engineer.
4. Furring Channels – Optional and can be directly applied to joists.
5. Bridging/Strongback - 2 x 6 SPF #2 to be screwed to the bottom chord with two 3" screws and spaced at 7' o.c.
6. Gypsum Board - 5/8" Type X Gypsum Board to be screwed with 1-1/2" Type W screws and spaced at 12" o.c. on intermediate joists and 6" o.c. on joist at butt joints.
7. Insulation (Optional) - All batts are to be placed between bottom joist flanges and supported by metal furring channels. In assemblies where metal furring channels are not utilized, support insulation batts on nominal 1" x 3" wood furring strips spaced 16" o.c. along the top side of the bottom flange. Equivalent methods that retain insulation above joist bottom flange are acceptable. All butt joints shall be over furring channels.

Figure 17.5.2

FIRE PERFORMANCE OF TRUSSES

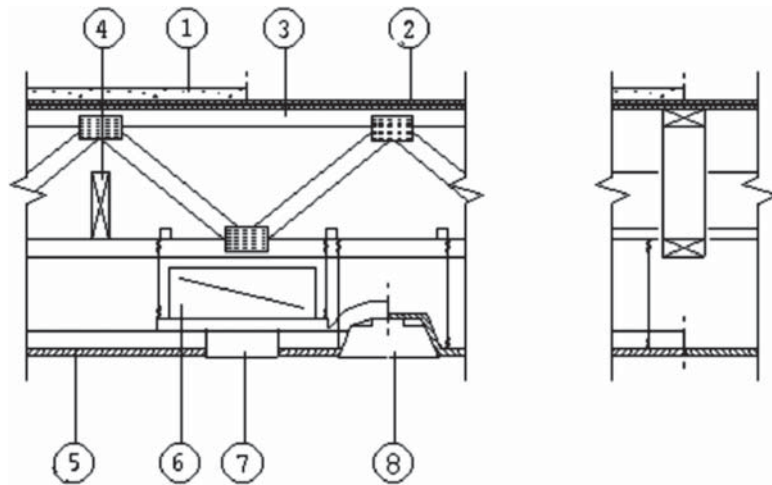
DESIGN NO. TSC/FCA 45-04

(Source: Intertek Testing Services, 2001 Directory of Listed Products)

SPECIFICATIONS

Fire Rating: 45 minutes

Finish Rating - 22 minutes



1. Topping (Optional) – Subject to design and project limitations, these systems may be augmented with a lightweight floor topping mix containing perlite or vermiculite aggregate.
2. Flooring - minimum 3/4" or 19.0 mm plywood or O-2 grade waferboard or strandboard.
3. Structural Member - Truswal metal truss plates with structural graded chords and webs as per NLGA grading rules and having a minimum depth of 10" and spaced up to a maximum of 24" o.c. for floor/ceiling systems. All FlorTrusses are to be designed and sealed by a Professional Engineer.
4. Bridging/Strongback - 2 x 6 SPF #2 to be screwed to the bottom chord with two 3" screws and spaced at 7' o.c.
5. Ceiling System - Suitable fire rated suspended ceiling system. Any suspended ceiling system may be selected which satisfies the following criteria:
 - a. It must be a fire rated system, and be installed within the terms of its listing
 - b. It must have a finish rating equal to or greater than the finish rating required by the suspended ceiling design.
 - c. It must be suspended in accordance with the terms of its listing and a minimum of 7-1/2" below the joist.
 - d. Penetrations such as ducts, air diffusers, and fixtures must be protected in such a manner as to conform to the terms of the listing of the suspended ceiling system.
6. Duct - see Item 5 above.
7. Air Diffuser - see Item 5 above.
8. Fixtures - see Item 5 above.

Figure 17.5.3

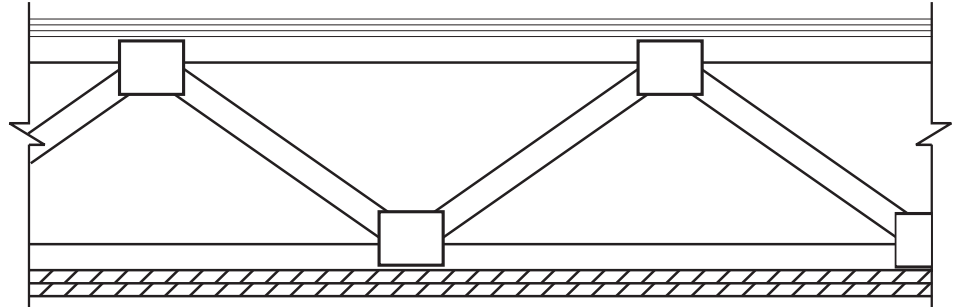
GA File No. FC5512

Source: Gypsum Association's, *Fire Resistance Design Manual*, 16th Edition, GA-600-2000.

SPECIFICATIONS

Fire Rating: 60 minutes

Finish Rating: Unknown



CEILING: Base layer 1/2" type X gypsum wallboard or gypsum veneer base applied perpendicular to wood trusses 24" o.c. with 1-1/4" Type S drywall screws 24" o.c. Face layer 1/2" type X gypsum wallboard or gypsum veneer base applied perpendicular to trusses with 1-7/8" Type S drywall screws 12" o.c. and 1-1/2" Type G drywall screws 12" o.c. placed 3" back from either side of end joints. Joints offset 24" from base layer joints.

TRUSSES: Chord and web members fabricated from 2 x 4 lumber with 20 gage steel connector plates having a minimum tooth length of 5/16". Plate design values based upon a safety factor of 4. Trusses have a minimum depth of 12".

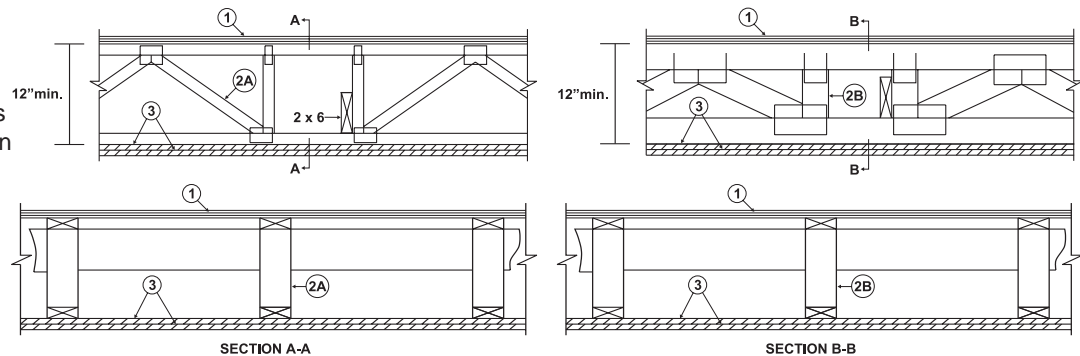
FLOORING: 19/32" T & G plywood with exterior glue applied at right angles to top of trusses with 6d common nails 6" o.c. Plywood end joints staggered 48".

Figure 17.5.4

FIRE PERFORMANCE OF TRUSSES

DESIGN NO. L542(Source: Underwriters Laboratory, Inc.'s *Fire Resistance Directory*, May 2 2002.)

SPECIFICATIONS
 Fire Rating: 60 minutes
 Finish Rating: Unknown



1. Finish Flooring: 4' x 8' x 23/32" thick interior plywood with exterior glue and tongue-and-groove edge detail along 8' sides. Plywood installed perpendicular to trusses with end joints staggered 4'. Plywood secured to trusses with construction adhesive and No. 6d ringed shank nails. Adhesive applied as 3/8" diameter bead to top chord of trusses and groove edges of plywood. Nails spaced 12" o.c. along each truss.

1A. Finish Flooring Systems - (not shown, optional) - to be placed over item 1.

2. Trusses: Parallel chord trusses spaced a maximum of 24" o.c. manufactured from nominal 2x4 lumber with lumber oriented either vertically (2A) or horizontally (2B). Truss members secured together with No. 20 MSG galvanized steel truss plates. Plates include 5/16" long teeth projecting perpendicular to the plane of the plate. The teeth are in pairs facing each other, and are made from the same punch, creating a split-tooth-type plate. Each tooth has a chisel point on its outside edge, with these points being diagonally opposite from each other for each pair. The four top half rows of each tooth has a twist for stiffness. The pairs are repeated at approximately 7/8" o.c. with four rows of teeth per inch of plate width.

3. Wallboard, Gypsum: Two layers of 1/2" thick by 48" wide sheets installed with long dimension perpendicular to trusses. The inner layer is attached to trusses using 1-1/4" long, Type S bugle head steel screws spaced 24" o.c. and located a minimum 1-1/2" from side and end joints. The outer layer is attached to trusses through the inner layer with 1-7/8" Type S bugle head steel screws spaced 12" o.c. All joints in the outer layer are offset 24" from inner layer joints. Butt joints occur over trusses.

Georgia-Pacific Corp, Gypsum Div. - Type 5.

Pabco Gypsum Co. - Type PG-C.

United States Gypsum Co. - Type C or IP-X2, IPEAR.

American Gypsum Co. - Types AG-C, AGX-C

Boval Gypsum, Inc. - Type BG-C

Canadian Gypsum Co. - Types C, IP-X2, IPC-AR

Continental Gypsum Co. - Types CG5-5, CG-C, CGTC-C

James Hardie Gypsum, Inc. - Type Max "C"

Laforge Gypsum - Types LGFC-C, LGFC-C/A

National Gypsum Co. - Type FSW-C

Standard Gypsum Co. - Type SG-C

Temple Inland Forest Products Corp. - Type TG-C

USG Mexico - Types C, IP-X2, IPC-AR

4. Finishing System: (Not shown) - Paper tape is embedded in cementitious compound over joints with edges of compound feathered out and exposed screw heads covered with compound. As an alternate, nominal 3/32" thick veneer plaster may be applied to the entire surface of gypsum wallboard.

Figure 17.5.5

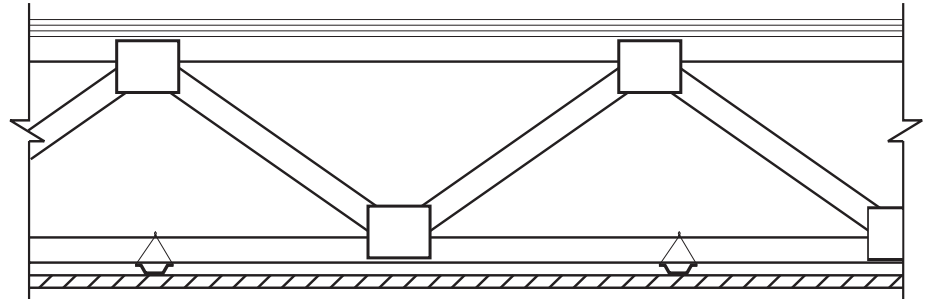
GA File No. FC5515

Source: Gypsum Association's, *Fire Resistance Design Manual*, 16th Edition, GA-600-2000.

SPECIFICATIONS

Fire Rating: 60 minutes

Finish Rating: Unknown



One layer 5/8" proprietary type X gypsum wallboard or gypsum veneer base applied at right angles to rigid furring channels 24" o.c. with 1" Type S drywall screws 12" o.c. and located a minimum of 1-1/2" from joints. Gypsum board end joints located midway between continuous channels and attached to additional pieces of channel 60" long with screws 12" o.c. Rigid furring channels applied at right angles to 12" deep parallel chord wood trusses 24" o.c. with double strand, 18 gage galvanized steel wire ties 48" o.c. Wood trusses supporting 3/4" nominal interior plywood with exterior glue, T & G edges, applied at right angles to trusses with construction adhesive and 6d ring shank nails 12" o.c. Adhesive applied to each top chord and grooved edges of plywood. End joints staggered 48". Consult gypsum board manufacturer for truss details.

PROPRIETARY GYPSUM BOARD

Celotex Corporation - 5/8" FI-ROK PLUS™

Continental Gypsum - 5/8" *More Rock*® FireBar® Type C, (CGTC-C)

G-P Gypsum - 5/8" GyProc® Fireguard® C

James Hardie Gypsum - 5/8" Hardirock® Brand Max "C"™ Gypsum Panels

Lafarge Gypsum - 5/8" Firecheck® Type C

Pabco Gypsum - 5/8" FLAME CURB® Super 'C'

Temple-Inland Forest Products Corporation - 5/8" FIRE-RATED "T"

United States Gypsum Company - 5/8" SHEETROCK® Brand Gypsum Panels, FIRECODE® C Core

Figure 17.5.6

FIRE PERFORMANCE OF TRUSSES

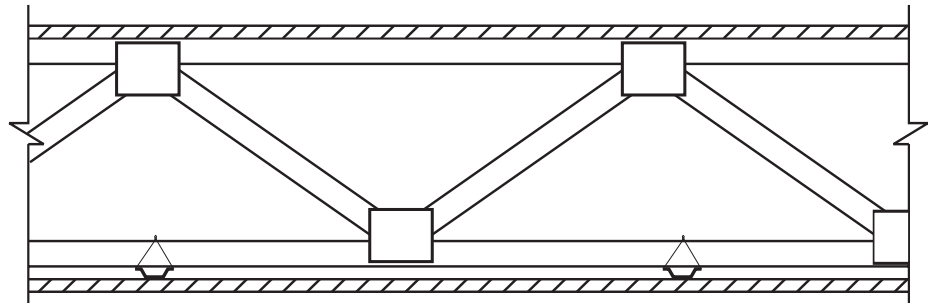
GA File No. FC5516

Source: Gypsum Association's *Fire Resistance Design Manual*, 16th Edition, GA-600-2000.

SPECIFICATIONS

Fire Rating: 60 minutes

Finish Rating: Unknown



One layer 5/8" proprietary type X gypsum wallboard or gypsum veneer base applied at right angles to rigid furring channels 24" o.c. with 1" Type S drywall screws 12" o.c. and 1-1/2" from edges. Gypsum board end joints located midway between continuous channels and attached to additional pieces of channel 60" long with screws 12" o.c. Rigid furring channels applied at right angles to 12" deep parallel chord wood trusses 24" o.c. with double strand, 18 gage galvanized steel wire ties 48" o.c. Wood trusses supporting 3/4" nominal interior plywood with exterior glue, T&G edges, applied at right angles to trusses with construction adhesive and either 6d smooth shank nails 6" o.c. at end joints and 12" o.c. at intermediate trusses or 6d ring shank nails 12" o.c. Adhesive applied to each top chord and grooved edges of plywood. End joints staggered 48". Consult gypsum board manufacturer for truss details.

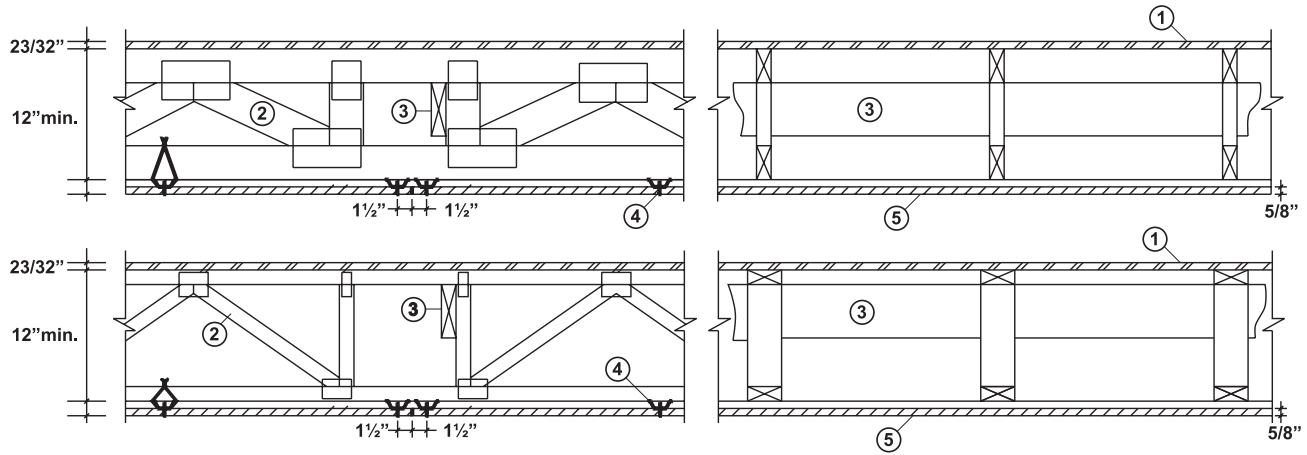
PROPRIETARY GYPSUM BOARD

National Gypsum Company - 5/8" Gold Bond® FIRE-SHIELD GTM Gypsum Wallboard

Figure 17.5.7

DESIGN NO. L528 & L534

(Source: Commentary and Appendices to ANSI/TPI 1-1995, Appendix E; and Underwriters Laboratory, Inc.'s *Fire Resistance Directory*, 1996.)


SPECIFICATIONS

Fire Rating: 60 minutes

Finish Rating: 22 minutes

1.Roof-Floor: Sheathing shall be a minimum 23/32" tongue-and-groove long edges. Long edges are installed perpendicular to trusses. Attach sheathing with a minimum 6d ring-shank nails 12" o.c. A 3/8" bead of adhesive is applied to the top chord of the trusses and in plywood grooves prior to placement. Optional minimum 3/4"-thick lightweight concrete or topping mixture may be installed, over the flooring described above, without affecting the fire-resistive rating.

2.Wood Trusses: Trusses shall be spaced a maximum of 24" o.c. and overall truss depth shall be a minimum of 12".

3.Bracing (Strongback): Bracing shall be minimum 2x6 grade marked lumber oriented vertically and installed perpendicular to trusses at a maximum spacing of 10' o.c. Secure to each truss with three 16d nails. Locate bracing as close to the bottom chord as possible.

4.Furring Channel: Formed of No. 25 MSG galvanized steel spaced 24" o.c. perpendicular to trusses. Channels secured to trusses with double strand of No. 18 SWG galvanized steel wire spaced 48" o.c. Channels spliced with adjacent pieces overlapped 6" and tied with double strand of No. 18 SWG galvanized steel wire at each end of overlap.

As an alternate to the furring channels, resilient channels formed from No. 26 MSG galvanized steel, spaced 16" o.c. perpendicular to trusses. Channels secured to trusses with Type S, 1-1/2" long steel screws spaced 24" o.c. Channels overlapped at splice 4".

5.Gypsum Wallboard: Install single layer of 5/8" US Gypsum Firecode C gypsum wallboard with long dimension perpendicular to furring or resilient channels. Directly secure to channels with 1" Type S drywall screws spaced 12" o.c. and located a minimum 1 1/4" from side and end joints. Wallboard joints are taped, and joints and screw heads are covered with a double layer of compound. As an alternate, nominal 3/32"-thick veneer plaster may be applied to the entire surface of gypsum wallboard.

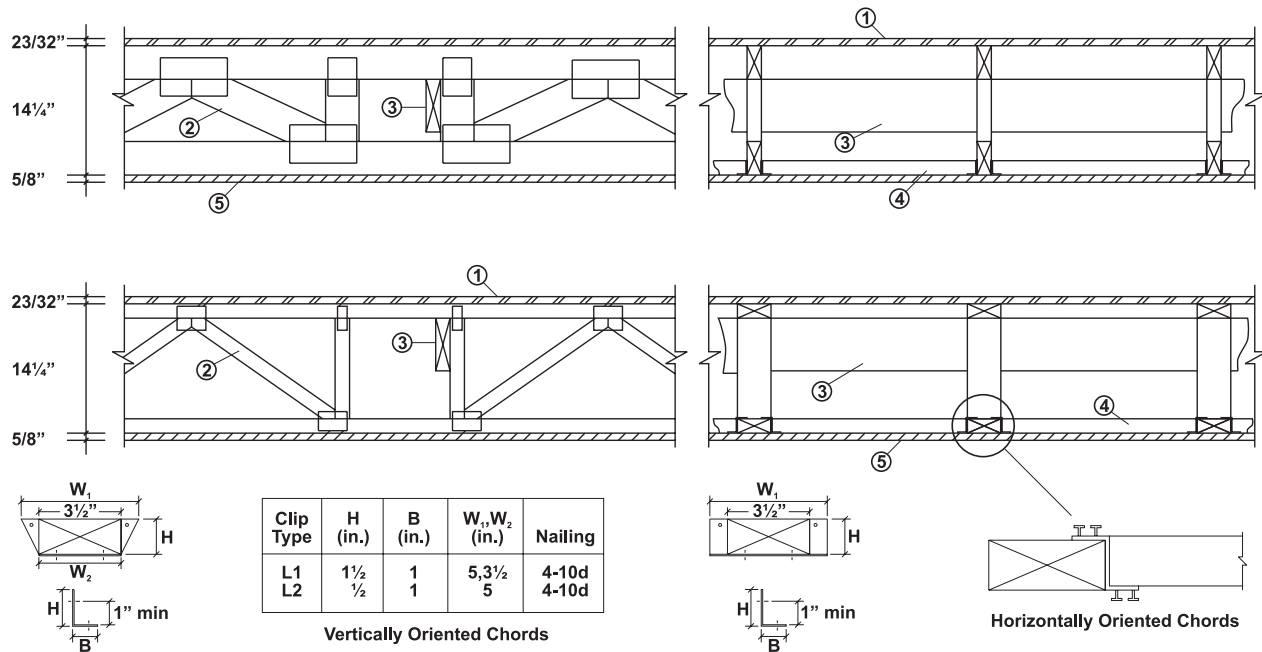
6.Other Listings: Design L528, *Fire Resistance Directory*, (Based on UL R9500-1, 2-2-81); and Design FC 5515, *Fire Resistance Design Manual*, Gypsum Association.

Figure 17.5.8

FIRE PERFORMANCE OF TRUSSES

TPI/WTCA'S Design No. FC 392

Source: Commentary and Appendices to ANSI/TPI 1-1995, Appendix E

**SPECIFICATIONS**

Fire Rating: 60 minutes

Finish Rating: 25 minutes

1. Roof-Floor: Sheathing shall be a minimum 23/32" tongue-and-groove long edges. Long edges are installed perpendicular to trusses. Attach sheathing with a minimum 6d deformed-shank nails at 6" o.c. A 3/8" bead of AFG-01 adhesive is applied to the top chord of the trusses and in plywood grooves prior to placement. Optional minimum 3/4" thick lightweight concrete or topping mixture may be installed, over the flooring described above, without affecting the fire-resistive rating.
2. Wood Trusses: Trusses shall be spaced a maximum of 24" o.c. and overall truss depth shall be a minimum of 14 1/4".
3. Bracing (Strongback): Bracing shall be minimum 2x8 grade marked lumber oriented vertically and installed perpendicular to trusses at a maximum 10' o.c. Secure to each truss with three 16d nails. Locate bracing as close to the bottom chord as possible.
4. Wallboard Edge Blocking: Adjacent ceiling wallboard edges perpendicular to trusses shall have nominal 2x4, 20 1/2" long fire-stop blocking oriented horizontally and centered lengthwise over the wallboard joints. Secure to lower truss chords with Z-clips or L-clips and four 10d common nails. See edge blocking detail above.
5. Gypsum Wallboard: Install single layer of 5/8" US Gypsum Firecode C gypsum wallboard with long dimension perpendicular to trusses. Stagger end joints on centerline of truss bottom chords. Directly secure to trusses with 1 7/8" long Type S bugle head steel screws having hi-lo threads. Screws are spaced 8" o.c. along all chords and blocking. Wallboard joints are taped, and joints and screw heads are covered with a double layer of compound.
6. Other Listings: ICBO Evaluation Report #4431 (discontinued); PFS Report #86-10, 3-18-86, by Kirk Grundahl, P.E., and Dr. Erwin L. Schaffer, P.E.

Figure 17.5.9

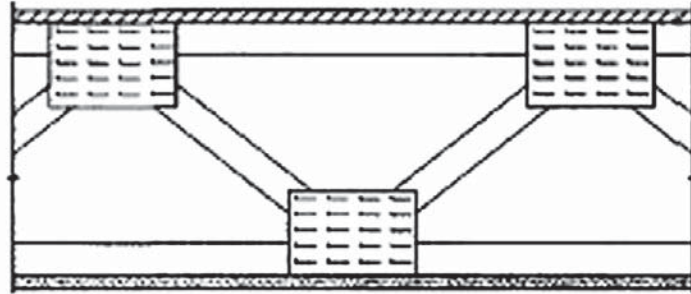
GA File No. FC 5517

Source: Gypsum Association's *Fire Resistance Design Manual*, 16th Edition, GA-600-2000.

SPECIFICATIONS

Fire Rating: 60 minutes

Finish Rating: Unknown



One layer 5/8" proprietary type X gypsum wallboard or gypsum veneer base applied at right angles to 12" deep parallel chord wood trusses 24" o.c. with 1-7/8" Type S drywall screws 8" o.c. to trusses and to 2 x 4 wood blocking installed between trusses, centered behind gypsum board edges and secured at each end to the trusses by nail attached 18 gage Z-shaped steel clips. Wood trusses supporting 5/8" nominal interior plywood with exterior glue, T & G edges, applied at right angles to trusses with construction adhesive and 6d smooth shank nails 12" o.c. in field and 6" o.c. along ends. Adhesive applied to each top chord and grooved edges of plywood. End joints staggered 48". Consult gypsum board manufacturer for truss details.

PROPRIETARY GYPSUM BOARD

National Gypsum Company - 5/8" Gold Bond® FIRE-SHIELD GTM Gypsum Wallboard

Figure 17.5.10

FIRE PERFORMANCE OF TRUSSES

NER-392 FR-SYSTEM 1™ (Source: National Evaluation Services, Inc., June 1, 2002)**SPECIFICATIONS**

Fire Rating: 60 minutes

Finish Rating: 23 minutes

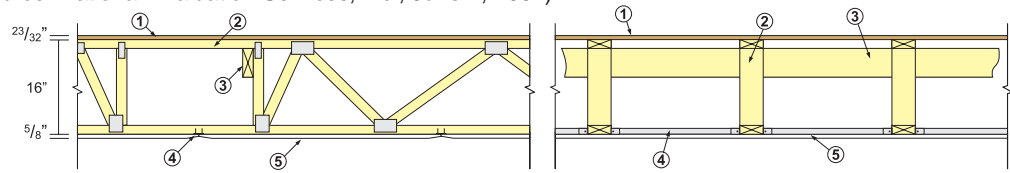


Figure 1a

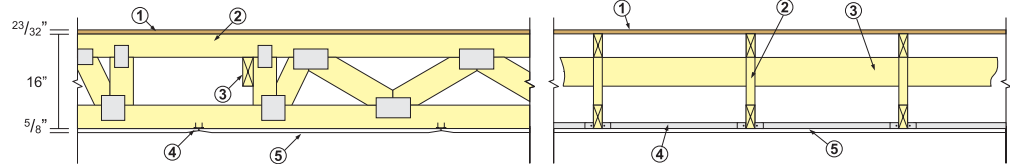


Figure 1b

1. Subfloor and Roof Sheathing: Sheathing shall be minimum 23/32" (18.3 mm) thick with tongue-and-groove long edges. Long edges shall be installed perpendicular to trusses. AFG-01 construction adhesive shall be applied as 3/8" diameter (9.5 mm) bead to the top chord of the trusses and to 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" (152 mm) o.c. at panel ends and 10" (254 mm) o.c. in the field. Alternately, with minimum 3/4" thick (19.1 mm) lightweight concrete or floor topping mixture, sheathing is permitted to be a minimum of 19/32" (15.1 mm) thick, if allowed by the finish floor manufacturer's specifications.
2. Wood Trusses: Trusses shall be spaced a maximum of 24" (610 mm) o.c. and shall have a minimum truss depth of 16" (406 mm).
Trusses shall be fabricated using nominal 2x3 or larger lumber, oriented either horizontally. Truss members shall be connected with galvanized steel truss plates, minimum No. 20 gage (MSG) [0.036" (0.91 mm)], with 5/16" (7.9 mm) or longer teeth projecting perpendicular to the plane of the plate. Truss bottom chord splices shall be connected with minimum No. 16 MSG [0.058" (1.47 mm)], 5/16" (7.9 mm), or longer, teeth projecting perpendicular to the plane of the plate. Additionally, truss plates shall have a current National Evaluations Services, Inc. (NES) evaluation report. Truss designs for parallel-chord and sloped trusses used in these assemblies shall be approved by the building official. Sloped trusses are trusses with chords that are not parallel, such as triangular trusses. Trusses shall be in compliance with the special inspection requirements for wood trusses indicated in the applicable code.
3. Bracing: Bracing shall be minimum 2X6 nominal lumber, oriented vertically and installed perpendicular to trusses on maximum 10' (3048 mm) centers. Bracing must be secured to each truss with three 16d nails.
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" long (25.4 mm), Type S drywall screw at each end.
FR-Quik Channel Sets™ and Bond Washers™ are manufactured by Alpine Engineered Products, Inc., using minimum No. 28 gage MSG [0.016" (0.41 mm) base-metal thickness] galvanized steel with minimum 33,000 psi (227 MPa) yield strength. Channels are 1-1/4" (31.7 mm) by 5/8" (15.9 mm), with sleeve ends permitting channels to move lengthwise. Washers are 1-1/4" (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 compound adhesion to the wallboard.
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 5/8" thick (15.9 mm) Celotex Fi-Rok Plus, Georgia Pacific Fire Stop C, Gold Bond Fire-Shield G, and U.S. Gypsum Firecode C, Type X gypsum wallboards. Wallboard end joints shall be staggered a minimum of 24" (610 mm). The wallboard shall be fastened directly to the trusses with 1-5/8" long (41.3 mm), Type S drywall screws on 8" (203 mm) centers, and shall be fastened to the FR Quik channels with Bond Washers and 1" long (25.4 mm), Type S screws spaced 8" (203 mm) o.c., driven through the crease between adjacent wallboards.
- 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 3/32" thick (2.38 mm) veneer plaster, complying with ASTM C 37, is permitted to be applied to the entire surface of the wallboard.

NER-392 FR-SYSTEM 3™ (Source: National Evaluation Services, Inc.)

SPECIFICATIONS

Fire Rating: 60 minutes

Finish Rating: 44 minutes

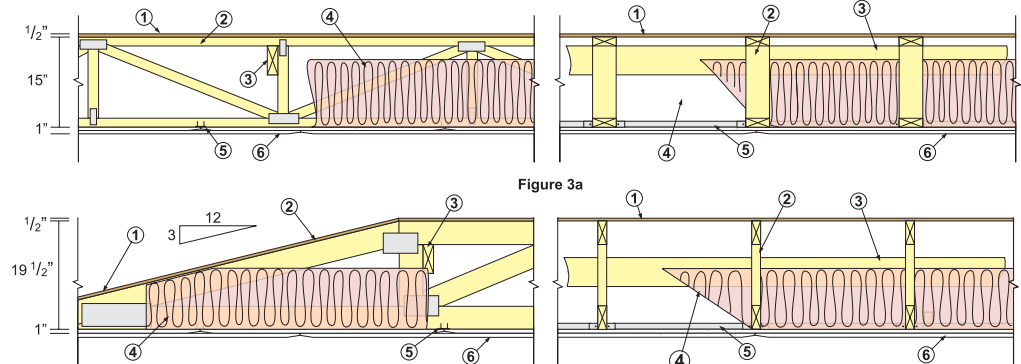


Figure 3a

Figure 3b

1. Subfloor and Roof Sheathing: Sheathing shall be minimum 15/32" (11.9 mm) thick, with long edges installed perpendicular to trusses. The sheathing shall be attached with 6d deformed shank nails or 8d common nails spaced 6" (152 mm) o.c. at panel ends and 12" (305 mm) o.c. in the field.
2. Wood Trusses: Trusses shall be spaced a maximum of 24" (610 mm) o.c. For parallel chord trusses, minimum depth shall be 15" (381 mm). For sloped trusses, slope shall be 3:12 or greater from each end, with a central portion depth of 19-1/2" (495 mm) or greater.

Trusses shall be fabricated using nominal 2x3 or larger lumber, oriented either horizontally. Truss members shall be connected with galvanized steel truss plates, minimum No. 20 gage (MSG) [0.036" (0.91 mm)], with 5/16" (7.9 mm) or longer teeth projecting perpendicular to the plane of the plate. Truss bottom chord splices shall be connected with minimum No. 16 MSG [0.058" (1.47 mm)], 5/16" (7.9 mm), or longer, teeth projecting perpendicular to the plane of the plate. Additionally, truss plates shall have a current National Evaluations Services, Inc. (NES) evaluation report. Truss designs for parallel-chord and sloped trusses used in these assemblies shall be approved by the building official. Sloped trusses are trusses with chords that are not parallel, such as triangular trusses. Trusses shall be in compliance with the special inspection requirements for wood trusses indicated in the applicable code.

3. Bracing: Bracing members that are minimum 2x6 nominal lumber are oriented vertically and installed perpendicular to trusses on maximum 10' centers (3048 mm). The brace members are fastened to each truss with three 16d nails.
4. Insulation: Insulation shall be glass fiber batts or rock wool. Flame spread rating shall be 25 or less. Insulation is permitted in plenum area, and can include direct contact with upper face of wallboard.
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" long (25.4 mm), Type S drywall screw at each end.

FR-Quik Channel Sets™ and Bond Washers™ are manufactured by Alpine Engineered Products, Inc., using minimum No. 28 gage MSG [0.016" (0.41 mm) base-metal thickness] galvanized steel with minimum 33,000 psi (227 MPa) yield strength. Channels are 1-1/4" (31.7 mm) by 5/8" (15.9 mm), with sleeve ends permitting channels to move lengthwise. Washers are 1-1/4" (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 compound adhesion to the wallboard.

Figure 17.5.12

NER-392 FR-SYSTEM 3™ Continued

6. Gypsum Wallboard: Two layers of 1/2" 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 a minimum of 24" (610 mm). The base layer shall be attached directly to trusses with one 5/8" long (41.3 mm), Type S drywall screws with Bond Washers spaced 12" (305 mm) o.c. The base layer is fastened to channel sets with Bond Washers and Type S, 1" long (25.4 mm) screws on 8" (203 mm) centers, driven through the crease between adjacent wallboards. The finish layer shall be fastened to trusses with 2-1/4" long (57 mm), Type S drywall screws on 8" (203 mm) centers.

An alternative installation using resilient channels consists of two layers of 1/2" 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 quickly to trusses with one 5/8" long (41.3 mm), Type S drywall screws spaced 12" (305 mm) o.c. The base layer is fastened to channel sets with Bond Washers and Type S, 1" long (25.4 mm) screws on 8" (203 mm) centers, driven through the crease between adjacent wallboards. Resilient channels formed of No. 25 gage [0.021" (0.53 mm)] MSG galvanized steel, spaced on 24" centers perpendicular to trusses, overlapped at splices 1-1/2" (38 mm), are fastened to each truss with an 8d nail or Type S, one 5/8" long (41.3 mm) screw. Minimum clearance of channels to walls shall be 3/4" (19.1 mm). Additional pieces 60" (1524 mm) long shall be placed immediately adjacent to end joints of the finish layer wallboard and shall extend 6" (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" long (25.4 mm) screws on 8" (203 mm) centers.

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" thick (2.38 mm) veneer plaster, complying with ASTM C 37, is permitted to be applied to the entire surface of the wallboard.

Design No. TSC/FCA 60-02

(Source: Intertek Testing Services, 2001 Directory of Listed Products)

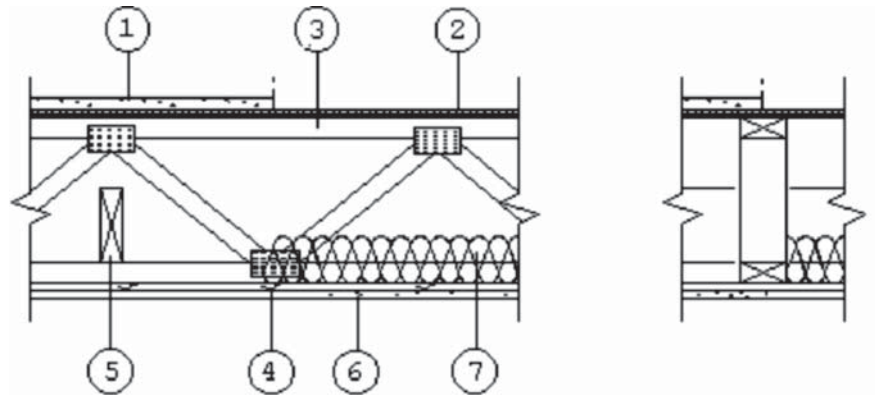
SPECIFICATIONS

Fire Rating: 60 minutes

Finish Rating - 22 minutes

STC 50 with Insulation & Resilient Channels

STC 57 with 1-1/2" Lightweight Concrete



1. Topping (Optional) - Subject to design and project limitations, these systems may be augmented with a lightweight floor topping mix containing perlite or vermiculite aggregate.
2. Flooring - minimum 3/4" or 19.0 mm plywood or O-2 grade waferboard or strandboard.
3. Structural Member - Truswal metal truss plates with structural graded chords and webs as per NLGA grading rules and having a minimum depth of 10" and spaced up to a maximum of 24" o.c. for floor/ceiling systems. All Floor Trusses are to be designed and sealed by a Professional Engineer.
4. Furring Channels (Resilient Channel) - 7/8" deep by 26 gauge galvanized steel wired to underside of each truss with double strands of 18 gauge steel tie wire or screwed to each truss with 1-1/4" Type S drywall screws. Double rows of furring channels at each gypsum wallboard joint (at least 3" apart).
5. Bridging/Strongback - 2 x 6 SPF #2 to be screwed to the bottom chord with two 3" screws and spaced at 7' o.c.
6. Gypsum Board - 4' x 10' x 5/8" Type C (listed Firecode C or Westroc Fireboard C) with long edges running perpendicular to the furring channels. Screwed to channels with 1-1/4" Type S bugle head drywall screws set at 12" o.c. and 1-1/2" from edges of board (minimum). All joints to be taped. Joints and screw heads covered with 2 layers of gyproc joint filler.
7. Insulation (Optional) - All batts are to be placed between bottom joist flanges and supported by metal furring channels. In assemblies where metal furring channels are not utilized, support insulation batts on nominal 1" x 3" wood furring strips spaced 16" o.c. along the top side of the bottom flange. Equivalent methods that retain insulation above joist bottom flange are acceptable. All butt joints shall be over furring channels.

Figure 17.5.13

FIRE PERFORMANCE OF TRUSSES

DESIGN NO. TSC/FCA 60-06

(Source: Intertek Testing Services, 2001 Directory of Listed Products)

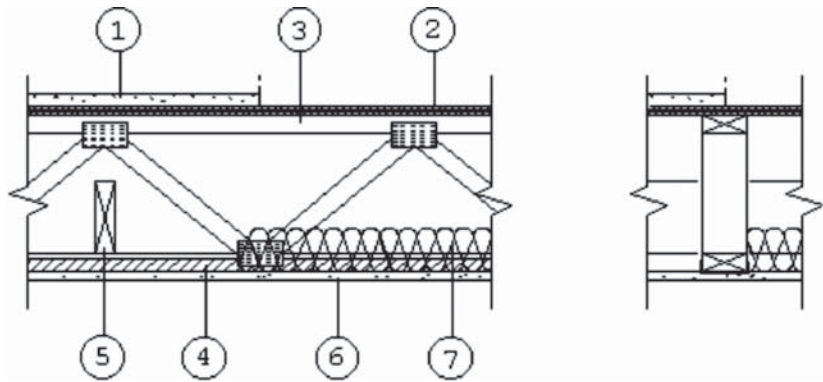
SPECIFICATIONS

Fire Rating: 60 minutes

Finish Rating - 24 minutes

STC 50 with Insulation and Resilient Channels

STC 57 with 1-1/2" Lightweight Concrete



1. Topping (Optional) - Subject to design and project limitations, these systems may be augmented with a lightweight floor topping mix containing perlite or vermiculite aggregate.

2. Flooring - minimum 3/4" or 19.0 mm plywood or O-2 grade waferboard or strandboard.

3. Structural Member - Truswal metal truss plates with structural graded chords and webs as per NLGA grading rules and having a minimum depth of 10" and spaced up to a maximum of 24" o.c. for floor/ceiling systems. All Floor Trusses are to be designed and sealed by a Professional Engineer.

4. TrusGard Protective Channels - No. 30 gauge steel channel secured to bottom chord of trusses during fabrication.

5. Bridging/Strongback - 2 x 6 SPF #2 to be screwed to the bottom chord with two 3" screws and spaced at 7' o.c.

6. Gypsum Board - 4' x 10' x 5/8" Type C (listed Firecode C or Westroc Fireboard C) with edges running perpendicular to the TrusGard. Screwed to channels with 1-1/4" Type S bugle head drywall screws set at 12" o.c. and 1-1/2" from edges of board (minimum). All joints to be taped. Joints and screw heads covered with 2 layers of gyproc joint filler.

7. Insulation (Optional) - All batts are to be placed between bottom joist flanges and supported by metal furring channels. In assemblies where metal furring channels are not utilized, support insulation batts on nominal 1" x 3" wood furring strips spaced 16" o.c. along the top side of the bottom flange. Equivalent methods that retain insulation above joist bottom flange are acceptable. All butt joints shall be over furring channels.

Figure 17.5.14

DESIGN NO. TSC/FCA 60-10

(Source: Intertek Testing Services, 2001 Directory of Listed Products)

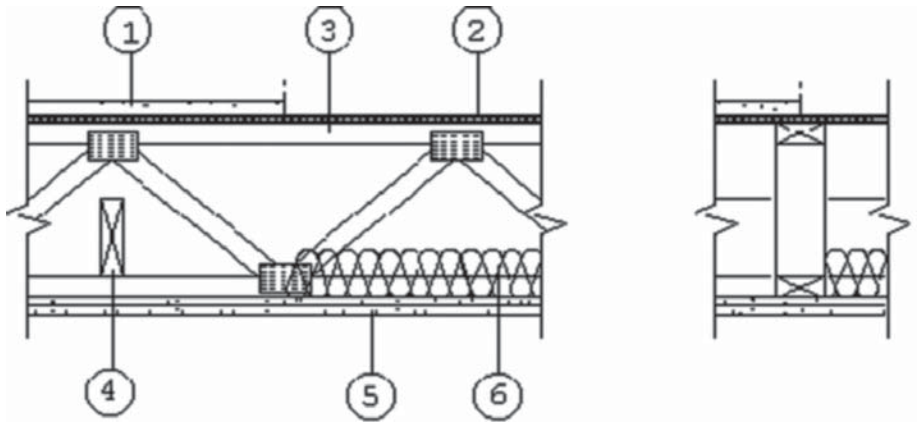
SPECIFICATIONS

Fire Rating: 60 minutes

Finish Rating: 45 minutes

STC 50 w/ Resilient Channels Only

STC 55 w/ min. 1-1/2" Topping Only



1. Topping (Optional) - Subject to design and project limitations, these systems may be augmented with a lightweight floor topping mix containing perlite or vermiculite aggregate.
2. Flooring - Minimum 3/4" or 19.0 mm plywood or O-2 grade waferboard or strandboard.
3. Structural Member - Truswal metal truss plates with structural graded chords and webs as per NLGA grading rules and having a minimum depth of 10" and spaced up to a maximum of 24" o.c. for floor/ceiling systems. All Floor trusses are to be designed and sealed by a Professional Engineer.
4. Bridging/Strongback - 2 x 6 SPF #2 to be screwed to the bottom chord with two 3" screws and spaced at 7' on center.
5. Gypsum Board - 2 layers of 1/2" Type X gypsum wallboard. Base layer to be installed with long dimensions perpendicular to supports, with end joints butted over supports and staggered 24" minimum. 1-1/4" Type W screws are spaced 12" o.c. on intermediate supports and 6" on center on supports at butt joints. Face layer installed with long dimension perpendicular to supports and edges staggered 24" from base layer end joints. Face Layer fastened with 2-1/4" Type W screws located minimum 12" on center on intermediate supports and 8" on center on end butt joints.
6. Insulation (Optional) - All batts are to be placed between bottom joist flanges and supported by metal furring channels. In assemblies where metal furring channels are not utilized, support insulation batts on nominal 1" x 3" wood furring strips spaced 16" o.c. along the top side of the bottom flange. Equivalent methods that retain insulation above joist bottom flange are acceptable. All butt joints shall be over furring channels.

Figure 17.5.15

FIRE PERFORMANCE OF TRUSSES

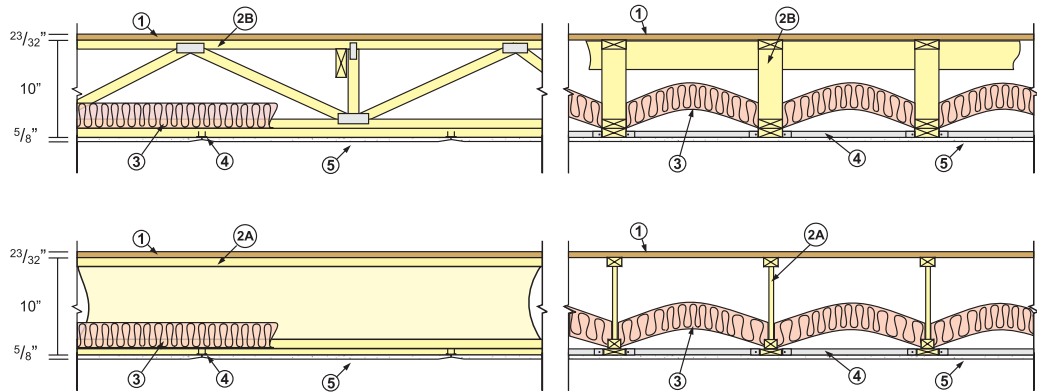
FR-SYSTEM5™

(Source: NER-392, 1991)

SPECIFICATIONS

Fire Rating: 60 minutes

Finish Rating: 26 minutes



1. Plywood Sheathing: Sheathing shall be minimum 23 3/32", 4x8 foot panels, with T & G long edges. Long edges are installed perpendicular to framing members. Apply AFG-01 construction adhesive as 3/8" diameter bead to top chord of trusses and grooved edge of panels. Nail with 6d deformed shank nails or 8d common nails on 6" centers on panel ends and 12" centers in the field.

2A. Wood I-Beams: Wood I-Beams shall be spaced a maximum of 24" o.c. and overall depth including shield member shall be 10" or greater. Secure to the underface of the I-Beams a minimum nominal 1x2 continuous wood shield member stapled 12" o.c., the same width of the I-Beam flange. Holes placed in the web shall be in accordance with the manufacturer's recommendations.

2B. Wood Trusses: Trusses shall be spaced a maximum of 24" o.c. and overall depth including shield member shall be 10" or greater. Web members in tension may be steel Tension Webs™ manufactured by Alpine Engineered Products, Inc. When truss members are oriented horizontally, secure to the underside of the bottom chord a minimum nominal 1" thick continuous wood shield member the same width as the bottom chord of the truss. The shield member may be pieced. When the truss members are oriented vertically, the bottom chord shall be a nominal 2" deeper than the design analysis depth with the actual truss depth 2" larger than the design analysis depth. Bracing shall be a minimum 2x6 nominal lumber oriented vertically and installed perpendicular to trusses on maximum 10 foot centers. Secure to each truss with three 16d nails.

Truss members shall be secured with Lumbermate Series T, Alpine, Alpine HS, or Woodloc galvanized steel truss plates, minimum No. 20 Manufacturer's Standard Gage (MSG) with minimum 5/16" or longer teeth projecting perpendicular to the plane of the plate. Truss bottom chord splices shall be secured with Lumbermate Series K or Alpine No. 16 galvanized steel truss plates, minimum No. 16 MSG. Truss plates shall have a current National Evaluation Services Report or applicable model code evaluation report. Truss designs for trusses used in these assemblies shall be approved by Alpine Engineered Products, Inc.

3. Insulation (optional): Insulation, if used, shall be batts or rolls of unfaced glass fiber, with a maximum dimension of 8-1/2" between the insulation and the ceiling membrane, installed with stay wires located between the framing members a minimum of 3/4" above the bottom flange of the framing member.

4. Wallboard Edge Blocking: Adjacent ceiling wallboard edges perpendicular to framing members shall have FR-Quik Channel Sets centered lengthwise over the wallboard joints. Secure to trusses with 1" long drywall screw at each end.

FR-Quik Channel Sets™ and Bond Washers™ are manufactured by Alpine Engineered Products, Inc., using minimum No. 28 gage MSG galvanized steel with minimum 33,000 psi yield strength. Channels are 1-1/4" by 5/8" with sleeve ends permitting channels to move lengthwise. Washers are 1-1/4" in diameter, with a center hole formed to match bugle-head drywall screws, and surrounding holes for finish compound adhesion to the wallboard.

5. Gypsum Wallboard: Install 5/8" thick Celotex Fi-Rok Plus, Georgia Pacific Fire Stop C, Gold Bond Fire Shield G, or US Gypsum Firecode C, Type X gypsum wallboard. Long dimensions are perpendicular to trusses. Stagger end joints on centerline of truss bottom chord or I-beam bottom flange. Directly secure to framing members with 2-1/4" long drywall screws on 8" centers. Secure to channel sets with Bond Washers and 1" long drywall screws 8" o.c. driven through the crease between adjacent gypsum boards.

6. Finish System (not shown): Paper tape embedded in joint compound over wallboard joints with edges of compound feathered out and exposed screw heads covered with compound. As an alternate, nominal 3/32" thick plaster may be applied to the entire surface of the wallboard.

Figure 17.5.16

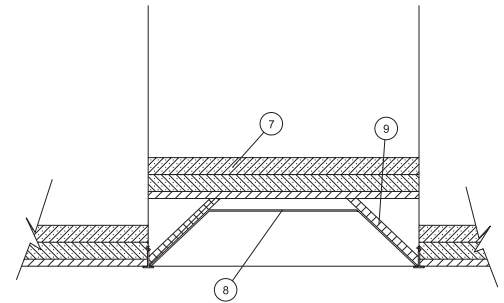
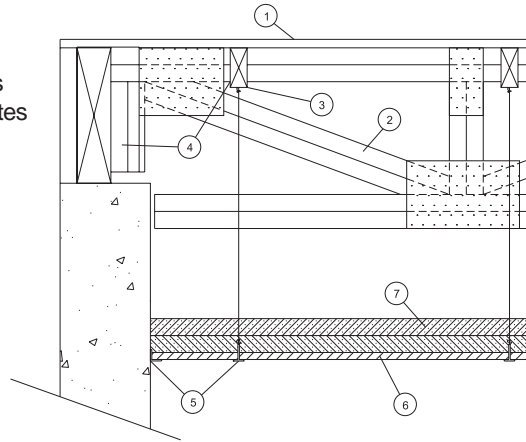
NER-399

Source: Council of American Building Officials, National Evaluation Service Committee. Donated to the Truss Industry by Weyerhaeuser Company. Report discontinued.

SPECIFICATIONS

Fire Rating: 60 minutes

Finish Rating: 35 minutes



Cross-section of light fixture installation

I. Description

1. Plywood: Plywood underlayment sheathing, 23/32", 5-ply conforming to PS 1-83, Exposure 1; in 4'x8' sheet lengths, installed perpendicular to trusses and fastened to truss chords and purlins using 6d deformed-shank nails 6" o.c. on perimeters and 12" o.c. in the field.
2. Wood Trusses: Parallel chord trusses 16" depth, spaced a maximum of 8' o.c., manufactured using minimum No. 20 Manufacturer's Standard Gauge (MSG) galvanized steel toothed truss plate with minimum 5/16" long teeth projecting perpendicular to the plane of the plate. Chords are 2-ply glue-laminated (phenol resin adhesive) minimum 2x4 finger-jointed lumber only and webs are 1-ply, 2-ply or 3-ply glue-laminated minimum 2x4 Spruce-Pine-Fir (SPF, 1650 psi Fb, 1.3 x 106 psi E) Machine Stress Rated (MSR) lumber.
3. Purlins: Structural 2x4 or 2x6 SPF MSR (1650f - 1.3E) lumber spaced 24" o.c.
4. Hangers: Simpson Strong-Tie HW412 Purlin Hanger for trusses, F24NP and F26NP panel hangers for purlins of 2x4 or 2x6 lumber respectively.
5. Ceiling Grid: Donn Corporation DX Ceiling Grid System with DXL \perp channels 15/16" wide by 1-1/2" high, M7 wall angles 7/8"x7/8" (Reg. UL R4651).
 - a. A 2' x 4' pattern is used for Armstrong Travertine Ceramaguard PC ceiling panels.
 - b. A 2' x 2' pattern is used for U.S.G. Fire Code Auratone ceiling panels.
6. Ceiling Tiles:
 - a. Armstrong Travertine Ceramaguard PC acoustical lay-in panel with acrylic finish in 23-3/4" x 47-3/4" x 5/8" thick dimension. The average weight per panel is 11.9 lb, or
 - b. U.S. Gypsum Fire Code Auratone Mineral Fiber Acoustical Ceiling Products Pattern: Omni Fissured Item 338 Square Edge 2'x 2'x 5/8". Printing on back of ceiling panel "Fire Rated Replace in Kind 21-6".
7. Insulation: Two layers of US Gypsum "Thermafiber" sound attenuation fire blanket, 1-1/2" thick, 0.51 psf, in 2' x 4' batts over ceiling tile and light fixtures.
8. Light Fixtures: Lithonia recessed fluorescent fixture of 2x4 dimension in plan (Ref. UL Issue No. 122, 935). Fixtures are paired and abutted at ends.
9. Light Protection:
 - a. Armstrong Ceramaguard PC acoustical lay-in tile, 5/8" thick or

Figure 17.5.17

FIRE PERFORMANCE OF TRUSSES

NER-399 Continued

- b. U.S. Gypsum Fire Code Auratone Mineral Fiber Acoustical Ceiling Products, 5/8" thick. Tiles are cut to form a five-sided enclosure trapezoidal in cross-section with 5/8" clearance to top of the light fixture housing. End pieces are held in place with three 8d nails spaced 8" o.c. No end pieces are used where fixtures abut. Instead, one 1-1/2" piece is placed on top of and centered over the gap between top pieces.
10. Assembly Penetrations: All penetrations for plumbing, mechanical, or electrical systems shall be protected in accordance with the building code.

ALTERNATIVE SYSTEMS

The following components may be substituted into the assembly described on page 17-24:

Other Weyerhaeuser structural components that are satisfactory alternates to the wood-webbed trusses are structural glue-laminated wood beams and structural all wood I-beams consistent with the structural requirements of the assembly, spaced a maximum of 8' o.c., and complying with No. 3 of Section V of this report.

Roof Sheathing

Single-layer structural roof sheathing of at least 19/32" thickness adequate to carry design load on purlins spaced 24" o.c. are acceptable alternatives to the 23/32" Group 1 Underlayment Plywood conforming to PS 1-83.

Decking-Flooring Systems

In addition to the 4' x 8' sheets of 23/32" plywood, other acceptable floor systems are (Reference UL Design L528):

System No. 1

Finish Flooring: 4' x 8' x 19/32" interior plywood with exterior glue and tongue-and-groove edge detail along 8' sides. Plywood installed perpendicular to trusses, with end joints staggered 4'. Plywood secured to trusses with construction adhesive and 6d ring shank nails. Adhesive applied as 3/8" diameter bead to top chord of trusses and groove edges of plywood. Nails spaced 12" o.c. along each truss. Truss spacing shall not exceed 20" o.c. Lightweight insulating concrete with Perlite or Vermiculite aggregate or gypsum concrete is placed on the flooring. The minimum thickness of insulating concrete shall be 3/4". The maximum thickness shall be determined by jobsite conditions. A thin plastic or paper vapor retarder may be placed on plywood prior to pouring the concrete.

System No. 2

Finish-Flooring Floor-Topping Mixture: 6.8 gal. of water to 80 lb of floor-topping mixture to 1.9 ft cu of sand. Thickness to be 3/4" minimum.

Hacker Industries, Inc. - FORTA-FILL Type I and II.

Sub-Flooring: 4' x 8' x 19/32" plywood with exterior glue, minimum to be "standard" conforming to PS 1-83 specifications. Face grain of plywood to be perpendicular to trusses, with joints staggered.

Structural Framing: Maximum spacing between trusses shall be 20" o.c.

System No. 3

Finish-Flooring Floor-Topping Mixture: 10-13 gal. of water to 170 lb of floor-topping mixture of 595 lb of sand. Compressive strength 900 psi minimum. Thickness to be 3/4" minimum.

Floor Crete Systems, Inc. - Type II.

Sub-Flooring: 4' x 8' x 19/32" interior plywood with exterior glue and tongue-and-groove edge detail along 8' sides. Plywood installed perpendicular to trusses, with end joint staggered 4'. Plywood secured to trusses with construction adhesive and 6d ring shank nails. Adhesive applied as 3/8" diameter bead to top chord of trusses and groove edges of plywood. Nails spaced 12" o.c. along each truss.

Structural Framing: Maximum spacing between trusses shall be 20" o.c.

System No. 4

Finish-Flooring Floor-Topping Mixture: 8 gal. of water to 80 lb of floor-topping mixture to 180 lb of sand. Compressive strength to be 1000 psi minimum. Thickness to be 3/4" minimum.

Gyp-Crete Corporation - Type GC.

United Gypsum Company - Type F.

Vapor Retarder (Optional): Commercial asphalt-saturated felt, 0.030" thick.

NER-399 Continued

Sub-Flooring: 4' x 8' x 19/32" interior plywood with exterior glue, minimum grade to be "standard" conforming to PS 1-83 specifications. Face grain of plywood to be perpendicular to trusses, with joints staggered.
Structural Framing: Maximum spacing between trusses shall not exceed 20" o.c.

System No. 5

Finish-Flooring Floor-Topping Mixture: A sufficient amount of water mixed with two bags of Portland Cement (Type III), one bag of Component A, one bag of Component B, and 1050 lb of saturated, surface dry sand. Thickness to be 1".

Master Builders - Type PC.

Sub-Flooring: 4' x 8' x 1/2" plywood with exterior glue, conforming to PS 1-83. Face grain laid perpendicular to trusses.

Structural Framing: Maximum spacing of framing members shall not exceed 16" o.c.

Purlins

In addition to the purlin lumber employed in this assembly, other structural materials providing support of the roof sheathing 24" o.c. or less and equivalent to nominal 2"x4" dimension or larger may be alternately used.

Hangers

Hangers for purlins and trusses of metal gauge thickness equal to or greater than those employed in the test are adequate alternatives. Hangers shall be installed in accordance with the manufacturer's installation instructions.

II. Installation

Installation instructions within this report will govern, if there are any conflicts with the manufacturer's instructions. The manufacturer's published installation instructions and this report shall be strictly adhered to and a copy of these instructions shall be available at all times on the jobsite during installation.

III. Identification

The fire resistive assembly described in this report shall be identified as NER-399 in the architectural specifications.

IV. Evidence Submitted

Test Report No. 86-32 dated October 10, 1986, by PFS Corporation of Madison, Wisconsin, lists the results of testing performed on a wood-webbed truss roof-ceiling assembly for the Weyerhaeuser Company. Tests were performed according to ASTM E119. Extension of Rating to Variances in Construction based upon PFS Test Report No. 86-32. This document is dated December 19, 1986.

Test Report No. 8812-E119-01, dated April 9, 1988, by Omega Point Laboratories, Small Scale ASTM E119-83 for U.S.G. Fire Code Auratone Ceiling Panels, 2' x 2' grid.

V. Conditions of Use

The National Evaluation Service Committee finds that the Weyerhaeuser Company's Fire Resistance Rated Floor-Ceiling or Roof-Ceiling Assembly described herein is found to comply with the requirements contained in the 1987 BOCA National Building Code and 1988 Supplement, the 1988 Standard Building Code, and the 1985 Uniform Building Code, subject to the following conditions:

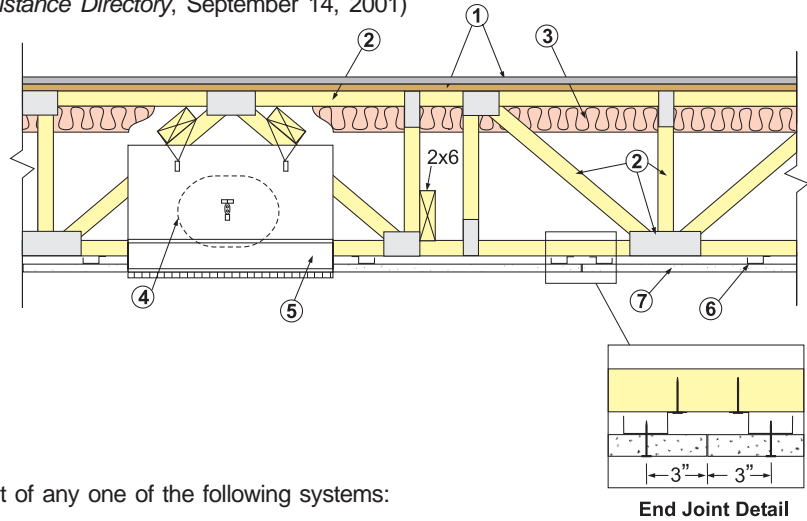
1. The Weyerhaeuser Company's Fire Resistive Rated Floor-Ceiling or Roof-Ceiling Assembly described herein are installed in accordance with this report and the manufacturer's instructions.
2. The scope of this report does not include the structural design of the floor-ceiling or roof-ceiling system. The structural system shall be designed in accordance with the building codes.
3. A fire resistance rated assembly designed and constructed in accordance with this report must provide the following:
 - a. a minimum plenum depth of 24", as measured from the top chord of the truss or alternate framing member to the top of the insulation on the suspended ceiling.
 - b. a minimum clearance of 8" between the bottom chord of the truss or alternate framing member and the top of the insulation.
4. Truss connector plates shall be listed in a current National Evaluation Service Report or individual model code agency report. The fire resistance rating of the assembly listed herein is one hour. The finish rating of the ceiling membrane is 35 minutes.

FIRE PERFORMANCE OF TRUSSES

Design No. L546(Source: Underwriters Laboratory, Inc.'s *Fire Resistance Directory*, September 14, 2001)**SPECIFICATIONS**

Fire Rating - 60 minutes

Finish Rating - 25 minutes



1. Flooring System The finish flooring may consist of any one of the following systems:

System No. 1

Finish Flooring Floor Topping Mixture* - 3 to 7 gal of water mixed with 80 lbs of floor topping mixture and 1.0 to 2.1 cu ft of sand. Compressive strength to be 1000 psi min. Thickness to be 3/4" min when used with 19/32" thick sub-flooring or 1" min when used with 15/32" thick sub-flooring.

MAXXON CORP - Type D-C, GC, GC2000, L-R or T-F

Floor Mat Material* - (Optional) - Floor mat material nom 1/4" thick adhered to sub-floor with Maxxon Floor Primer. Primer to be applied to the surface of the mat prior to lath placement.

MAXXON CORP - Type Acousti-Mat

Metal Lath - For use with floor mat material, 3/8" expanded galvanized steel diamond mesh, 3.4 lbs/sq yd placed over the floor mat material. Floor topping thickness a nom 1" over the floor mat.

Alternate Floor Mat Materials* - (Optional) - Floor mat material nom 1/4" thick loose laid over the subfloor. Maxxon Floor Primer to be applied to the surface of the mat prior to the floor topping placement. Floor topping thickness a min 1" over the floor mat.

MAXXON CORP - Type Acousti-Mat II.

Subflooring - 15/32" or 19/32" thick wood structural panels, min grade "Underlayment" or "Single Floor" with exterior glue conforming to PS1-83 specification or nonveneer APA rated sheathing panels per APA specifications PRP-108. Long dimension of panel (strength axis) or face grain of plywood to be perpendicular to joists with joints staggered.

System No. 2

Finish Floor -Mineral and Fiber board*, sizes ranging 3' by 4' to 8' by 12', by min. 1/2" thick. All joints to be staggered a min. of 12" o.c. with adjacent sub-floor joints.

HOMASOTE CO - Type 440-32 Mineral and Fiber Board

Sub-flooring - 1" by 6" T & G fastened diagonally to joists; or 15/32" thick plywood or 7/16" thick oriented strand board (OSB) wood structural panels, min grade "C-D" or "Sheathing". Face grain of plywood or strength axis of panel to be perpendicular to joists with joints staggered.

System No. 3

Finish Flooring-Floor Topping Mixture* - Foam concentrate mixed 40:1 by volume with water and expanded at 100 psi through nozzle. Mix at rate of 1.4 cu ft of preformed foam to 94 lbs Type I Portland cement and 300 lbs of sand with 5-1/2 gal of water. Cast density of floor topping mixture 100 plus or minus 5 pcf. Min compressive strength 1000 psi. Thickness 1-1/2"

ELASTIZELL CORP OF AMERICA - Type FF.

Vapor Barrier - (Optional)- Commercial asphalt saturated felt, 0.030" thick.

Subflooring - 15/32" thick wood structural panels, min grade "C-D" or "Sheathing". Face grain of plywood or strength axis of panels to be perpendicular to joists with joints staggered.

Figure 17.5.18

Design No. L546 Continued

System No. 4

Finish Flooring-Floor Topping Mixture* - Foam concentrate mixed 40:1 by volume with water and expanded at 100 psi through nozzle. Mix 94 lbs cement, 300 lbs sand, approx. 5.4 gal water, 1.2 cu ft preformed foam, 5 oz Type N fiber and 4 oz Component Z. Cast density of floor topping mixture shall be 105 plus or minus 5 pcf with min compressive strength of 1200 psi. Min thickness shall be 3/4"

ELASTIZELL CORP OF AMERICA - Type ZC.

Subflooring - 15/32" thick wood structural panels, min grade "C-D" or "Sheathing" . Face grain of plywood or strength axis of panels to be perpendicular to joists with joints staggered.

System No. 5

2. Trusses Parallel chord trusses, spaced a max of 24" o.c., fabricated from nom 2 by 4 lumber, with lumber oriented vertically or horizontally. Min truss depth is 18" Truss members secured together with min 0.0356" thick galv steel plates. Plates have 5/16" long teeth projecting perpendicular to the plane of the plate. The teeth are in pairs facing each other (made by the same punch), forming a split tooth type plate. Each tooth has a chisel point on its outside edge. These points are diagonally opposite each other for each pair. The top half of each tooth has a twist for stiffness. The pairs are repeated on approximately 7/8" centers with four rows of teeth per inch of plate width.

3. Batts and Blankets* (Optional) - Glass fiber insulation, max 3-1/2" thick, secured to the plywood subflooring with staples spaced 12" o.c. or to the trusses with 0.090" dia galv steel wires spaced 12" o.c.. Any glass fiber insulation bearing the UL Classification Marking as to Surface Burning Characteristics and/or Fire Resistance, having a min density of 0.5 pcf. As an option, the insulation may be fitted in the concealed space, draped over the resilient channels and gypsum wallboard ceiling membrane when the resilient channels and gypsum wallboard attachment is modified as specified in Items 6 and 7. The finished rating has only been determined when the insulation is secured to the decking.

4. Air Duct* Any UL Class 0 or Class 1 flexible air duct installed in accordance with the instructions provided by the damper manufacturer.

5. Ceiling Damper* Maximum nominal area, 324 sq in Maximum square size, 18" by 18" Rectangular sizes not to exceed 324 sq in. with a maximum width of 18". Maximum damper height is 14" Installed in accordance with the manufacturers installation instructions provided with the damper. Maximum damper openings not to exceed 162 sq in. per 100 sq ft of ceiling area.

C&S AIR PRODUCTS - Model RD-521

POTTORFF CO INC - Model CFD-521

6. Furring Channels Resilient channels, 3/8" deep by 2-3/8" wide at the base and 1-3/8" wide at the face, formed from 0.020" thick galv steel, spaced 16" o.c. installed perpendicular to trusses. When insulation, Item 3 is draped over the resilient channel/ gypsum wallboard ceiling membrane, the spacing shall be 12" o.c. Channels secured to each truss with 1-1/4" long Type S steel screws. Channels overlapped 4" at splices. Channels oriented opposite at wallboard butt joints (spaced 6" o.c.) as shown in the above illustration.

7. Gypsum Board* Nom 5/8" thick, 48" wide, installed with long dimension perpendicular to resilient channels with 1" long Type S screws spaced 12" o.c. and located a min of 1/2" from side joints and 3" from the end joints. At end joints, two resilient channels are used, extending a min of 6" beyond both ends of the joint. When insulation, Item 3 is draped over the resilient channel/gypsum wallboard ceiling membrane, screws shall be installed at 8" o.c.

CANADIAN GYPSUM COMPANY - Types C, IP-X2, IPC-AR.

UNITED STATES GYPSUM CO - Types C, IP-X2, IPC-AR.

USG MEXICO S A DE C V - Types C, IP-X2, IPC-AR.

8. Finishing System (Not shown) - Vinyl, dry or premixed joint compound, applied in two coats to joints and screw-heads; paper tape, 2" wide, embedded in first layer of compound over all joints. An alternate, nom 3/32" thick veneer plaster may be applied to the entire surface of gypsum wallboard.

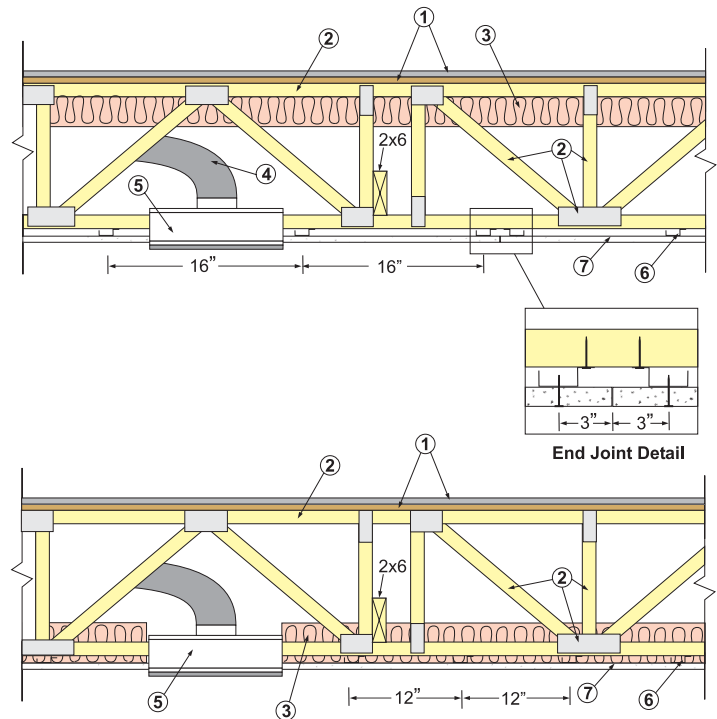
*Bearing the UL Classification Mark.

FIRE PERFORMANCE OF TRUSSES

Design No. L550 (Source: Underwriters Laboratory, Inc.'s Fire Resistance Directory, April 19, 2002)

SPECIFICATION

Fire Rating - 60 minutes
 Finish Rating - 23 minutes
 (See Items 3 or 3A)



1. Flooring System The finish flooring may consist of any one of the following systems:

System No. 1

Finish Flooring - Nom 1" by 4" T&G; laid perpendicular to trusses; or 15/32" thick plywood, min grade "Underlayment" or "Sturd-I-Floor" with T&G long edges, and conforming with PS 1-83 specifications; or nonveneer APA rated Sturd-I-Floor, T&G panels per APA specifications PRP-108. Long dimensions of panel (strength axis) or face grain of plywood to be perpendicular to trusses with joints staggered.

Vapor Barrier - (Optional) - Commercial asphalt saturated felt, 0.030" thick.

Subflooring - 23/32" thick plywood with T&G edges along the 8' sides and exterior glue; or nonveneer APA rated Sturd-I-Floor T&G panels per APA specifications PRP 108. installed perpendicular to trusses with end joints staggered 4' Plywood or nonveneer APA rated panels secured to trusses with construction adhesive and No. 6d ringed shank nails. Nails spaced 12" o.c. along each truss. Staples having equal or greater withdrawal and lateral resistance strength may be substituted for the 6d nails.

System No. 2

Finish Flooring - Floor Topping Mixture* - 6.8 gal of water to 80 lbs of floor topping mixture to 1.9 cu ft of sand. Compressive strength to be 1100 psi min. Thickness to be 3/4" min.

HACKER INDUSTRIES INC. - Firm-Fill, Firm-Fill 2010, Firm-Fill 4010, Firm-Fill High Strength, GypSpan Radiant.

Subflooring - 23/32" thick plywood with T&G edges along the 8' sides and exterior glue, or nonveneer APA rated Sturd-I-Floor T&G panels per APA specifications PRP-108. Installed perpendicular to trusses with end joints staggered 4' Plywood or nonveneer APA rated panels secured to trusses with construction adhesive and No. 6d ringed shank nails. Nails spaced 12" o.c. along each truss. Staples having equal or greater withdrawal and lateral resistance strength may be substituted for the 6d nails.

System No. 3

Finish Floor Mineral and Fiber board*, sizes ranging from 3' by 4' to 8' by 12', by min 1/2" thick. All joints to be staggered a min of 12". o.c. with adjacent sub-floor joints.

HOMASOTE CO - Type 440-32 Mineral and Fiber Board.

Figure 17.5.19

Design No. L550 Continued

2. Trusses Parallel chord trusses, spaced a max of 24" o.c, fabricated from nom 2 by 4 lumber, with lumber oriented vertically or horizontally. Min truss depth is 18" Truss members secured together with min 0.0356" thick galvanized steel plates. Plates have 5/16" long teeth projecting perpendicular to the plane of the plate. The teeth are in pairs facing each other (made by the same punch), forming a split tooth type plate. Each tool has a chisel point on its outside edge. These points are diagonally opposite each other for each pair. The top half of each tooth has a twist for stiffness. The pairs are repeated on approx. 7/8" centers with four rows of teeth per inch of plate width.
3. Batts and Blankets* (Optional) - Glass fiber insulation, max 3-1/2" thick, secured to the plywood subflooring with staples spaced 12" o.c. or to the trusses with 0.090" dia galv steel wires spaced 12" o.c. Any glass fiber insulation bearing the UL Classification Marking as to Surface Burning Characteristics and/or Fire Resistance, having a min density of 0.5 pcf. As an option the insulation may be draped over the resilient channels and gypsum wallboard ceiling membrane when the resilient channels and gypsum wallboard attachment is modified as specified in Items 6 and 7. The finished rating has only been determined when the insulation is secured to the decking.

3A. Loose Fill Material* As an alternate to Item 3 when insulation is draped over resilient channels and gypsum wallboard ceiling membrane - Any loose fill material bearing the UL Classification Marking for Surface Burning Characteristics, having a min density of 0.5 pcf and installed at a max thickness of 3-1/2" When used the resilient channel and gypsum wallboard attachment is modified as specified in Items 6 and 7. The finished rating when loose fill material is used has not been determined.
4. Air Duct* Any UL Class 0 or Class 1 flexible air duct installed in accordance with the instructions provided by the damper manufacturer.
5. Damper* Nom 12" long by 12" wide by 6" high, fabricated from galvanized steel. installed in accordance with the instructions provided by the manufacturer. Max damper openings not to exceed 144 sq in per 100 sq ft of ceiling area.
NAILOR INDUSTRIES INC. - Type 0755, 0756, 0757.
6. Furring Channels Resilient channels, 3/8" deep by 2-3/8" wide at the base and 1-3/8" wide at the face, formed from 0.020 in. thick galv steel, spaced 16" o.c., installed perpendicular to trusses. When insulation, Item 3 or 3A, is draped over the resilient channel/gypsum wallboard ceiling membrane, the spacing shall be 12" o.c. Channels secured to each truss with 1-1/4" long Type S steel screws. Channels overlapped 4" at splices. Channels oriented opposite at wallboard butt joints (spaced 6" o.c.) as shown in the above illustration.
7. Gypsum Board* Nom 5/8" thick, 48" wide, installed with long dimension perpendicular to resilient channels with 1" long Type S screws spaced 12" o.c. and located a min of 1/2" from side joints and 3" from the end joints. At end joints, two resilient channels are used, extending a min of 6" beyond both ends of the joint. When insulation, Item 3 or 3A, is draped over the resilient channel/gypsum wallboard ceiling membrane, screws shall be installed at 8" o.c.

CANADIAN GYPSUM COMPANY - Types C, IP-X2, IPC-AR.
UNITED STATES GYPSUM CO - Types C, IP-X2, IPC-AR.
USG MEXICO S A DE C V - Types C, IP-X2, IPC-AR.
8. Finishing System (Not shown) - Vinyl, dry or premixed joint compound, applied in two coats to joints and screw-heads; paper tape, 2" wide, embedded in first layer of compound over all joints. As an alternate, nom 3/32" thick veneer plaster may be applied to the entire surface of gypsum wallboard.

Alternate Ceiling Membrane - Not Shown Not for use when insulation (Item 3) is used.