



ICC Evaluation Service, Inc.
www.icc-es.org

Business/Regional Office ■ 5360 Workman Mill Road, Whittier, California 90601 ■ (562) 699-0543
Regional Office ■ 900 Montclair Road, Suite A, Birmingham, Alabama 35213 ■ (205) 599-9800
Regional Office ■ 4051 West Flossmoor Road, Country Club Hills, Illinois 60478 ■ (708) 799-2305

Legacy report on the 1997 Uniform Building Code™

DIVISION: 03—CONCRETE

Section: 03540—Cementitious Underlayment

FIRM-FILL®, FIRM-FILL® 2010, FIRM-FILL® 3310, FIRM-FILL High Strength, FIRM-FILL® 4010 AND GYP-SPAN® RADIANT GYPSUM CONCRETES

HACKER INDUSTRIES, INC.
23 CORPORATE PLAZA DRIVE, SUITE 200
NEWPORT BEACH, CALIFORNIA 92660

1.0 SUBJECT

FIRM-FILL®, FIRM-FILL® 2010, FIRM-FILL® 3310, FIRM-FILL High Strength, FIRM-FILL® 4010 and GYP-SPAN® Radiant Gypsum Concretes.

2.0 DESCRIPTION

2.1 General:

FIRM-FILL, FIRM-FILL 2010, FIRM-FILL 3310, FIRM-FILL High Strength, FIRM-FILL 4010 and GYP-SPAN Radiant Gypsum Concretes are intended for use as a topping over subflooring. These materials are mixed on the job and pumped into place by applicators approved by Hacker Industries, Inc. The gypsum concrete floor topping has an approximate dry density of 100 pounds per cubic foot (1602 kg/m³) and a minimum 28-day compressive strength of 1,200 psi (82.6 MPa) when tested in accordance with ASTM C 472. In-place weights are:

- 1. FIRM-FILL Gypsum Concrete: 6.5 psf (0.311 kN/m²) at 3/4 inch (19.1 mm) thick
2. FIRM-FILL 2010: 6.8 psf (0.326 kN/m²) at 3/4 inch (19.1 mm) thick
3. FIRM-FILL 3310: 7.6 psf (0.364 kN/m²) at 3/4 inch (19.1 mm) thick
4. FIRM-FILL High Strength: 7 psf (0.335 kN/m²) at 3/4 inch (19.1 mm) thick
5. FIRM-FILL 4010: 7.8 psf (0.374 kN/m²) at 3/4 inch (19.1 mm) thick
6. GYP-SPAN Radiant: 14 psf (0.770 kN/m²) at 1 1/2 inches (38 mm) thick

The mix proportions are as follows:

- 80 pounds of FIRM-FILL, FIRM-FILL 2010, FIRM-FILL 3310, FIRM-FILL High Strength, FIRM-FILL 4010 or GYP-SPAN Radiant Gypsum Concrete (one bag)
• 1.9 cubic feet (0.0538 m³) of sand

- 6 to 7.5 gallons (22.7 to 28.4 L) of water

FIRM-FILL 2010, FIRM-FILL 3310, FIRM-FILL High Strength, FIRM-FILL 4010 and GYP-SPAN Radiant Gypsum Concretes are acceptable alternates to FIRM-FILL in all applications and assemblies described in this report.

2.2 Applicable Uses:

- 1. FIRM-FILL Gypsum Concrete is applied at a minimum 3/4-inch (19.1 mm) thickness over a minimum 5/8-inch-thick (15.9 mm) 40/20 plywood subfloor with or without tongue-and-groove or blocked butt joints over joists spaced a maximum of 20 inches (508 mm) on center and installed in accordance with the code. One coat of latex bonder is applied to the subfloor by roller or sprayer at a coverage of 500 square feet (46 m²) per gallon. The bonder is liquid latex with 48 percent solids diluted one to four with water. The ceiling is applied in accordance with the code.
2. When FIRM-FILL Gypsum Concrete is placed over joists 24 inches (610 mm) on center, minimum construction consists of 1 inch of FIRM-FILL Gypsum Concrete over minimum 19/32-inch-thick (15.1 mm) CD grade plywood subfloor with exterior glue, installed in accordance with the code. The plywood bears a span index of 40/20.
3. FIRM-FILL Gypsum Concrete is placed from 3/4 to 3 1/2 inches (19.1 to 89 mm) thick over structurally sound wood floors for leveling purposes. One coat of asphalt emulsion is required to completely seal the subfloor. The asphalt emulsion is Type SS-1 and is mopped or squeezed onto the subfloor and allowed to become tacky (approximately two hours) prior to placement of the gypsum concrete.
4. FIRM-FILL Gypsum Concrete is placed at a minimum 1/2-inch (12.7 mm) thickness over precast concrete as a topping for leveling purposes. Concrete with a water absorption of 12 percent or more can be wetted, using water, within 15 minutes of the gypsum concrete installation. If water absorption is less than 12 percent, the concrete must be rolled or sprayed with Hacker Industries' liquid latex bonder at a coverage rate of 400 square feet (36.8 m²) per gallon. This bonder must be allowed to dry prior to placement of the gypsum concrete.
5. FIRM-FILL Gypsum Concrete is placed from 3/8 to 3 1/2 inches (9.5 to 89 mm) thick to level existing concrete floors in the same manner as described for precast concrete. The concrete surface must be free of all oil, grease and other contaminants.
6. GYP-SPAN Radiant gypsum concrete is used with radiant heating installations. The gypsum concrete is placed a minimum 3/4-inch (19.1 mm) thick above radiant tubing.

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7. The following acoustical mat products are permitted to be used with the FIRM-FILL Gypsum Concrete construction described in this report, including the fire-resistive construction described in Items 1 and 2 in Section 2.3 of this report.
- QUIET-QURL (QQ)—An extruded polymer matrix of tangled monofilaments topped with a nonwoven fabric. Total thickness is $\frac{1}{4}$ inch (6.4 mm).
 - HACKER SOUND MAT (HSM)—A dense rubber mat with a thin film. Total thickness is $\frac{1}{4}$ inch (6.4 mm).

When used, the acoustical mats shall be installed between the subfloor and FIRM-FILL Gypsum Concrete (minimum thickness of 1 inch (25.4 mm) in accordance with the manufacturer's instructions.

The specific amount of increase in sound transmission class or impact insulation class attained by the installation of the acoustical mats has not been evaluated in this evaluation report.

2.3 One-hour Fire-resistive Wood Floor-ceiling Constructions:

- FIRM-FILL Gypsum Concrete may be used as an alternate to the double-wood floor assembly required by footnote 13 to Table 7-C of the code. The thickness of FIRM-FILL must be a minimum $\frac{3}{4}$ inch (19.1 mm) when installed over minimum $\frac{5}{8}$ -inch-thick (15.9 mm) plywood subflooring and minimum 1 inch (25.4 mm) thick when installed over minimum $\frac{1}{2}$ -inch-thick (12.7 mm) plywood subflooring. Plywood span rating is as required by the code.
- FIRM-FILL Gypsum Concrete floor toppings may be used as a substitute for $\frac{5}{8}$ -inch (15.9 mm) plywood finished flooring. The fire-rated assemblies are noted in Figures 1 and 2. As an alternate, $\frac{1}{2}$ -inch-thick (12.7 mm) plywood with a span rating of $\frac{32}{16}$ or 16 inches (406 mm) on center may be substituted for $\frac{5}{8}$ -inch-thick (15.9 mm) plywood, provided minimum FIRM-FILL thickness is increased to 1 inch (25.4 mm).
- FIRM-FILL Gypsum Concrete, when applied at a 1-inch (25.4 mm) thickness over minimum $\frac{5}{8}$ -inch-thick (15.9 mm) plywood subfloor with a minimum grade CD, Exposure 1, or CD with exterior glue, is considered an alternate underlayment to those specified in one-hour fire-resistive assemblies described in NER-148 and NER-200 for Trus Joist® assemblies. The face grain of the plywood must be perpendicular to joists with plywood end joints

staggered from adjacent courses. The maximum joist spacing is 24 inches (610 mm). Where the trusses or joists are limited to a maximum 20 inches (508 mm) on center spacing, the FIRM-FILL thickness may be reduced to $\frac{3}{4}$ inch (19.1 mm).

2.4 Sound Transmission:

The assemblies described in Figures 1 and 2 have a minimum Sound Transmission Class (STC) of 50 and a minimum Impact Insulation Class (IIC) of 50, as required by Section 1208.1 of the Uniform Building Code Appendix.

2.5 Identification:

FIRM-FILL, FIRM-FILL 2010, FIRM-FILL 3310, FIRM-FILL High Strength, FIRM-FILL 4010 and GYP-SPAN Radiant Gypsum Concrete floor toppings are identified by the Hacker Industries, Inc. name and address and the product name printed on the 80-pound (36.3 kg) bags.

Hacker Sound Mat is identified by a label on the stretch wrap of each roll [48" x 30' (1219 mm by 9.14 m)]. This label indicates the product name, thickness and the Hacker Industries, Inc. name.

QUIET QURL™ is identified by a label on the top of each 100-foot (30.5 m) roll that indicates the product name and the Hacker Industries, Inc. name.

Additionally, all products are identified with the evaluation report number (ER-4147).

3.0 EVIDENCE SUBMITTED

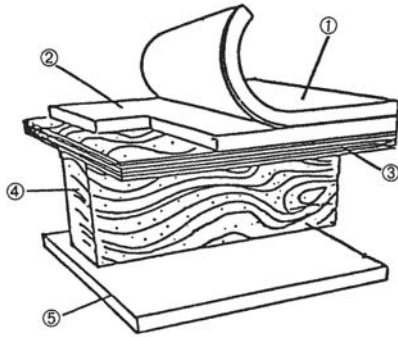
Reports of fire tests in accordance with UBC Standard 7-1 and sound-insulation tests in conformance with ASTM Standards E 90-83, E 413-73 (1980) and E 492-77.

4.0 FINDINGS

That Hacker Industries, Inc., FIRM-FILL®, FIRM-FILL® 2010, FIRM-FILL® 3310, FIRM-FILL High Strength, FIRM-FILL® 4010 and GYP-SPAN® Radiant Gypsum Concretes as described in this report comply with the 1997 Uniform Building Code™, subject to the following conditions:

- The gypsum concrete is applied only by applicators approved by Hacker Industries, Inc.**
- The density of the material is at least 100 pounds per cubic foot (9.2 m³) for one-hour fire-resistive floor-ceiling assemblies.**

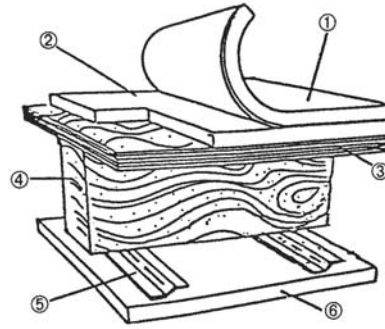
This report is subject to re-examination in one year.



1. Floor covering
2. $\frac{3}{4}$ -inch (min.) FIRM-FILL Gypsum Concrete
3. $\frac{5}{8}$ -inch plywood installed in accordance with the code
4. 2 by 10 wood joist, 16 inches on center
5. $\frac{5}{8}$ -inch Type X gypsum board installed in accordance with the code

For a minimum Sound Transmission Class of 50, the floor-ceiling assembly is constructed as described in Figure 1, except minimum 1-inch-thick FIRM-FILL Gypsum Concrete is applied over the plywood. For a minimum Impact Insulation Class of 50, the assembly is also constructed as described in Figure 1, except minimum 1-inch-thick FIRM-FILL is applied over the plywood. Additionally, floor covering consisting of minimum 17-ounce-weight carpet over $\frac{3}{8}$ -inch-thick foam pad must be applied over the FIRM-FILL.

FIGURE 1



1. Floor covering
2. $\frac{3}{4}$ -inch (min.) FIRM-FILL Gypsum Concrete
3. $\frac{5}{8}$ -inch plywood installed in accordance with the code
4. 2 by 10 wood joist, 16 inches on center
5. Resilient channel, 24 inches on center. Channels are No. 25 gage installed perpendicular to the joists and overlapped at 4 inches at each splice. Fastening to joist is by $1\frac{1}{4}$ -inch-long furring screw.
6. $\frac{5}{8}$ -inch Type X gypsum board, minimum 4 feet wide, installed with long dimension perpendicular to furring channels with 1-inch-long wallboard screws spaced at 12 inches on center.

For a minimum Impact Insulation Class of 50, floor covering consisting of minimum 20-ounce carpet over $\frac{1}{2}$ -inch-thick foam pad is required. As an alternate, vinyl tile floor covering with R-11 insulation batts between joists may be substituted.

FIGURE 2