HACKER INDUSTRIES, INC.

FIRM-FILL® and GYP-SPAN® Floor Toppings and Underlayment Assemblies

CSI Sections:
03 54 00 Cementitious Underlayment

1.0 RECOGNITION

Hacker Industries' FIRM-FILL® and GYP-SPAN® Radiant gypsum concretes, mats and assemblies have been evaluated for use as floor leveling toppings/underlayments, and for sound transmission requirements in accordance with Section 1207 of the IBC and Appendix K of the IRC, and for use in fire-resistance rated floor/ceiling assemblies in accordance with Section 703 of the IBC and Section R302 of the IRC, as applicable. The gypsum concrete underlayments, mats and assemblies have been evaluated for composition, strength, density, sound transmission, and fire-resistance. The Hacker Industries, Inc. FIRM-FILL® and GYP-SPAN® Radiant assemblies evaluated in this report are satisfactory alternatives to the following codes:

- 2015, 2012 and 2009 International Building Code® (IBC)
- 2015, 2012 and 2009 International Residential Code® (IRC)

2.0 LIMITATIONS

Use of Hacker Industries, Inc. FIRM-FILL® and GYP-SPAN® Radiant gypsum concrete assemblies recognized in this report are subject to the following:

2.1 Installation of the gypsum concrete shall be by applicators approved by Hacker Industries, Inc.

2.2 The gypsum concrete underlayments shall be covered with an interior floor finish complying with Section 804 of the IBC, and shall not be used in exterior locations, below grade, or where continuous exposure to moisture is likely.

2.3 Evaluation of specific interior floor finishes and floor coverings, as applicable, for compliance with requirements of Section 804 of the IBC is outside of the scope of this report.

2.4 Use of combustible materials installed on or embedded in floors of buildings of Type I or II construction shall comply with Section 805.1 of the IBC.

2.5 Supporting subfloors shall be limited to deflections not exceeding l/360.

3.0 PRODUCT USE

3.1 Hacker Industries' FIRM-FILL®, FIRM-FILL® 2010, FIRM-FILL® 3310, FIRM-FILL® High Strength, FIRM-FILL® 4010 and GYP-SPAN® Radiant gypsum concretes, mats and assemblies are used as poured floor leveling toppings/underlayments. The gypsum concretes have a flame spread index of 0 and a smoke-developed index of 0 when tested in accordance with ASTM E84.

3.2 The gypsum concrete assemblies described in Table 3 of this report have a sound transmission class (STC) of not less than 50 when tested in accordance with ASTM E90 and an impact insulation class (IIC) rating of not less than 50 when tested in accordance with ASTM E492, as required by Section 1207 of the IBC and Appendix K of the IRC.

3.3 The gypsum concrete assemblies noted in Table 4 of this report may be used as fire-resistance rated floor/ceiling assemblies in accordance with Section 703 of the IBC and Section R302 of the IRC, as applicable.

3.4 FIRM-FILL® and GYP-SPAN® Radiant gypsum concrete shall be installed in accordance with this report, the manufacturer's installation instructions and the applicable code, whichever is most severe.

3.5 GYP-SPAN® Radiant gypsum concrete may be used over radiant heating systems.

4.0 PRODUCT DESCRIPTION

4.1 Gypsum Concrete: Hacker Industries' gypsum concrete floor underlayments recognized in this report shall have the properties shown in Table 1 of this report.

TABLE 1 - FIRM-FILL® AND GYP-SPAN PROPERTIES

	COMPRESSIVE STRENGTH - MINIMUM (psi)	**INSTALLED WEIGHT** [1] (psf)
FIRM-FILL® [2, 3, 4]	1,200	7.0
FIRM-FILL® 2010+ [2]	2,000	7.2
FIRM-FILL® 3310 [2, 3]	2,500	7.6 (at ¾")
FIRM-FILL® High Strength [3]	2,500	7.7
FIRM-FILL® 4010 [5]	4,000	7.9
FIRM-FILL® CMD [6]	3,500	12.8
GYP-SPAN® Radiant [7]	2,000	14.6 at 1½"

For SI: 1 inch = 25.4 mm, 1 psi = 0.00689 MPa, 1 psf = 0.0479 kPa
[1] At minimum thickness.
[2] for use over wood; thickness: ¾" minimum, 3½" maximum
[3] for use over concrete; thickness: ½" minimum, 3½" maximum
[4] for use over steel; thickness: 1" minimum, 2" maximum
[5] for use over concrete; thickness: ½" minimum, 2" maximum
[6] for use over corrugated metal decking: $1^{9}/_{16}$" minimum
[7] used with radiant heat systems; thickness: ¾" minimum, 1½" maximum, over the top of the radiant system tubes.

The mix proportions are 80 lbs. (36.3 kg) bag of gypsum concrete to 1.9 cubic feet (0.0538 m^3) of sand and 6 to 7.5 gallons (22.7 to 28.4 L) of water. Bags of FIRM-FILL® and GYP-SPAN® gypsum concrete have a shelf life of 12 months when stored in bags in dry conditions.

4.2 Sound Control Mat: Hacker Industries' sound control mats recognized in this report have the properties shown in Table 2 of this report.

TABLE 2 - SOUND CONTROL MAT PROPERTIES

	THICKNESS (inch)	ROLLS	
		DIMENSIONS (width x length)	WEIGHT (lbs)
FIRM-FILL® SCM-125	1/8	60" x 80'	33
FIRM-FILL® SCM-250	¼	60" x 80'	39
FIRM-FILL® SCM-400	3/8	60" x 80'	39

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 lbs = 0.004448 kN

The sound control mats are laid flat over supporting subflooring and covered with Hacker Industries' gypsum concretes described in this report. FIRM-FILL® SCM are random filament polymer matrix mats. FIRM-FILL® SCM-250 has a corrugated, 'U' groove.

5.0 IDENTIFICATION

Bags of FIRM-FILL® and GYP-SPAN® Radiant gypsum concrete are identified with the manufacturer's name, address, product name and Evaluation Report number (ER-474). Sound mats are identified by a label with the manufacturer's name, product name, thickness, and Evaluation Report number (ER-474). Either Mark of Conformity may be used as shown below:

IAPMO ES® or UES™

IAPMO UES ER-474

6.0 SUBSTANTIATING DATA

6.1 Reports of Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete in accordance with ASTM C472.

6.2 Reports of testing for Airborne Sound Transmission Loss in accordance with ASTM E90.

6.3 Reports of testing for Impact Sound Transmission in accordance with ASTM E492.

6.4 Reports of testing for Effectiveness of Floor Coverings in Reducing Impact Sound Transmission Through Concrete Floors in accordance with ASTM E2179

6.5 Reports of Fire Tests of Building Construction and Materials in accordance with ASTM E119.

6.6 Test results are from laboratories in compliance with ISO/IEC 17025.

6.7 Manufacturer's descriptive literature and installation instructions.

7.0 CONTACT INFORMATION

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8.0 STATEMENT OF RECOGNITION

This evaluation report describes the results of research carried out by IAPMO Uniform Evaluation Service on Hacker Industries, Inc. FIRM-FILL® and GYP-SPAN® Radiant gypsum concrete underlayments and floor toppings and FIRM-FILL® sound mats to assess their conformance to the codes and standards shown in Section 1.0 of this report and documents the product's certification.

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For additional information about this evaluation report please visit www.uniform-es.org or email us at info@uniform-es.org

TABLE 3 - SOUND CLASS ASSEMBLIES

GYPSUM CONCRETE TYPE	SUB-FLOORING (inch)	SOUND MAT	GYPSUM CONCRETE (inch)	FLOOR FINISH / FLOOR COVERING	NOTES
Open Web Truss (wood, 18", l/360) (resilient channels @ 24" o.c., 1 layer of 5/8" gypsum board ceiling, 3½" thick unfaced fiberglass batt insulation) See Figure 5 of this report.					
FIRM-FILL®	¾" OSB	none	¾	Carpet & Pad	
	23/32" OSB		1	Wood laminate	
	23/32" OSB			2 mm vinyl sheet	9" fiberglass batt insulation
	¾" OSB	SCM-125	¾	2 mm vinyl sheet or tile; 13 mm wood flooring	
	¾" OSB	SCM-250	1	2 mm vinyl sheet or tile; 8 mm ceramic tile; 13 mm wood flooring	
	¾" OSB	SCM-400	1¼	2 mm vinyl sheet or tile; 8 mm ceramic tile; 13 mm wood flooring	
Nominal Wood (2" x 10" dimensional lumber @ 16" o.c.) (resilient channels @ 24" o.c., 1 layer of 5/8" gypsum board ceiling, 3½" thick unfaced fiberglass batt insulation) See Figure 4 of this report.					
FIRM-FILL®	¾" OSB	none	¾	Carpet & pad	
	¾" OSB	SCM-125	¾	2 mm vinyl sheet; 3 mm vinyl tile; 8 mm ceramic tile; 13 mm wood flooring	
	¾" OSB	SCM-250	¾	2 mm vinyl sheet; 3 mm vinyl tile; 8 mm ceramic tile; 13 mm wood flooring	
	5/8" plywood	SCM-250	¾	Wood laminate; carpet & pad	
	¾" OSB	SCM-400	1¼	2 mm vinyl sheet; 3 mm vinyl tile; 8 mm ceramic tile; 13 mm wood flooring	
I-Joist (12" wood I-joist) (resilient channels @ 16" o.c., 1 layer of 5/8" gypsum board ceiling) See Figure 3 of this report.					
FIRM-FILL®	¾" OSB	SCM-125	¾	2mm vinyl sheet or tile; 8 mm ceramic tile; ½" wood flooring	
	¾" OSB	SCM-125	¾	2mm vinyl sheet or tile; 8 mm ceramic tile; 13 mm engineered wood flooring	2 layers of 5/8" gypsum board ceiling
	¾" OSB	SCM-250	1	2mm vinyl sheet; 3 mm vinyl tile; 8 mm ceramic tile; ½" engineered wood flooring	
	¾" OSB	SCM-250	1	2 mm vinyl sheet; 8 mm ceramic tile; 13 mm engineered wood flooring	2 layers of 5/8" gypsum board ceiling; resilient furring channels and/or hat channels
	¾" OSB	SCM-400	1¼	2 mm vinyl sheet; 3 mm vinyl tile; 8 mm ceramic tile; 13 mm engineered wood flooring[1]	2 layers of 5/8" gypsum board ceiling
6" Concrete Assembly See Figure 1 of this report.					
FIRM-FILL®	na	SCM-125	¾	na	IIC Δ 20 [2]
	na	SCM-250	1	na	IIC Δ 20 [2]
	na	SCM-400	1¼	na	IIC Δ 23 [2]

For **SI**: 1 inch = 25.4 mm

[1] May also be installed using 1 layer of 5/8" gypsum board ceiling.

[2] When tested in accordance with ASTM E2179

TABLE 4 - FIRM-FILL® and GYP-SPAN FIRE-RESISTANCE RATED ASSEMBLIES [1]

GYPSUM CONCRETE TYPE	SOUND MAT	GYPSUM CONCRETE THICKNESS	UL DESIGN NUMBER	NOTES
Nominal Wood (2" x 10" dimensional lumber @ 16" o.c.) (5/8" wood structural panel subflooring; 3½" unfaced fiberglass batt or mineral wool insulation; resilient channels @ 16" o.c. fastened to each truss with 1¼" long Type S screws; 1 layer of 5/8" Type C gypsum board ceiling fastened with 1-inch-long Type S bugle head steel screws space 12 inches o.c. in the field and 6 inches o.c. along the butt joints) See Figure 4 of this report.				
FIRM-FILL®, FIRM-FILL® 2010+, FIRM-FILL® 3310, FIRM-FILL® 4010, FIRM-FILL® High Strength, or GYP-SPAN® Radiant	SCM-125	¾"	BXUV UL Design No. L598	1-Hour fire-resistance rated
	SCM-250	1"		
	SCM-400	1¼"		
Open Web Truss (fabricated from nominal 2 by 4 lumber with minimum 12" truss depth, spaced maximum 24" o.c., l/360,) (23/32" wood structural panel subflooring; 3½" unfaced fiberglass batt or mineral wool insulation; resilient channels [2];1 layer of 5/8" gypsum board ceiling fastened with 1-inch-long Type S bugle head steel screws space 12 inches o.c.) See Figure 5 of this report.				
FIRM-FILL®, FIRM-FILL® 2010+, FIRM-FILL® 3310, FIRM-FILL® 4010, FIRM-FILL® High Strength, or GYP-SPAN® Radiant	SCM-125	¾"	BXUV UL Design No. L550	1-Hour fire-resistance rated.
	SCM-250	1"		
	SCM-400	1¼"		
Open Web Truss (fabricated from nominal 2x4 lumber with 12" truss depth, spaced maximum of 24" o.c. l/360) (3/4" wood structural panel subflooring; 3" fiberglass batt or mineral wool insulation; resilient channels[2]; 1 layer of 5/8" gypsum board ceiling fastened with 1-inch-long Type S bugle head steel screws space 12 inches o.c.) See Figure 5 of this report.				
FIRM-FILL®, FIRM-FILL® 2010+, FIRM-FILL® 3310, FIRM-FILL® 4010, FIRM-FILL® High Strength, or GYP-SPAN® Radiant	N/A	¾"	N/A	1-Hour fire-resistance rated
	SCM-125	¾"	N/A	
	SCM-250	1"	N/A	
	SCM-400	1¼"	N/A	
I-Joist (minimum 9½" wood I-joists spaced maximum of 24" o.c.) (19/32" wood structural panel subflooring; unfaced fiberglass batt insulation secured to bottom of subflooring; resilient channels [2]; 2 layers of ½" or 5/8" gypsum board ceiling with the base layer fastened with 1" long Type S screws spaced 16" o.c in the field and 8" o.c at the butt joints and the face layer fastened with 1 5/8" long Type S screws spaced 8" o.c. in the field and 1 5/8" long Type G screws spaced 8" o.c. at the butt joints located mid-span between resilient channels) See Figure 3 of this report.				
FIRM-FILL®, FIRM-FILL® 2010+, FIRM-FILL® 3310, FIRM-FILL® 4010, FIRM-FILL® High Strength, or GYP-SPAN® Radiant	SCM-125	¾"	BXUV UL Design No. L570	1-Hour fire-resistance rated.
	SCM-250	1"		
	SCM-400	1¼"		
Corrugated Metal Deck (14 mm deep 22 gage galvanized corrugated fluted steel deck; structural steel shall be minimum 9¼" deep No. 16 gage spaced at maximum 24" o.c. with joist bridging; resilient channels @ 12" o.c.; 1 or 2 layers of 5/8" gypsum board ceiling [3, 4]; 3½" thick unfaced fiberglass batt or mineral wool insulation) See Figure 2 of this report.				
FIRM-FILL® CMD [5]	SCM-125	1"	BXUV UL Design No. G565	1½-Hour Fire-resistance Rated[3] 2-Hour Fire-resistance Rated[4]
	SCM-250	1		
	SCM-400	1¼"		

For **SI**: 1 inch = 25.4 mm

[1] ASTM E119 / UL 263 / CAN/ULC-S101

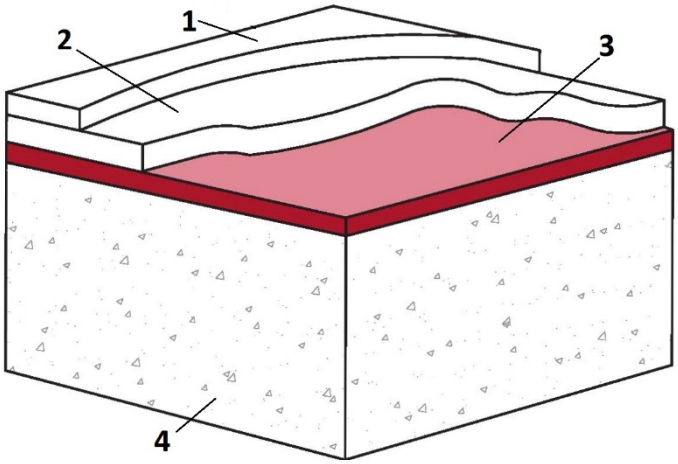
[2] Resilient channels shall be spaced maximum of 24" o.c. when no batt insulation is present, 16" o.c. when insulation is installed to the underside of the subflooring, and 12" o.c. when installed over the resilient channels.

[3] 1-layer of 5/8" Type C gypsum board ceiling fastened with 1" long Type S bugle-head screws spaced 8" o.c in the field and perimeter.

[4] 2-layers of 5/8" Type C gypsum board ceiling with the base layer fastened with 1" long Type S bugle-head screws spaced 8" o.c in the field and at the perimeter, face layer installed with joints offset 24" from base layer and fastened with 1 5/8" long Type S screws spaced 8" o.c. in the field and the perimeter and fastened with Type G screws spaced 8" o.c. at the butt joints.

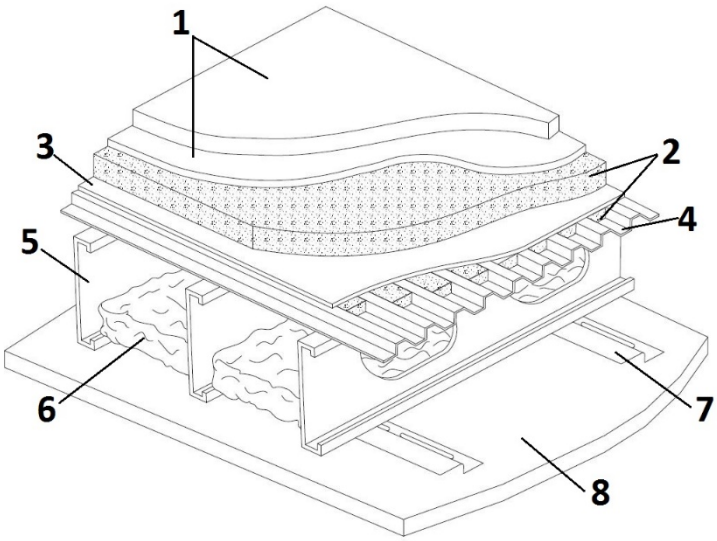
[5] Minimum compressive strength of FIRM-FILL CMD shall be 3,500 psi.

Figure 1 – 6-inch Concrete with Sound Mat



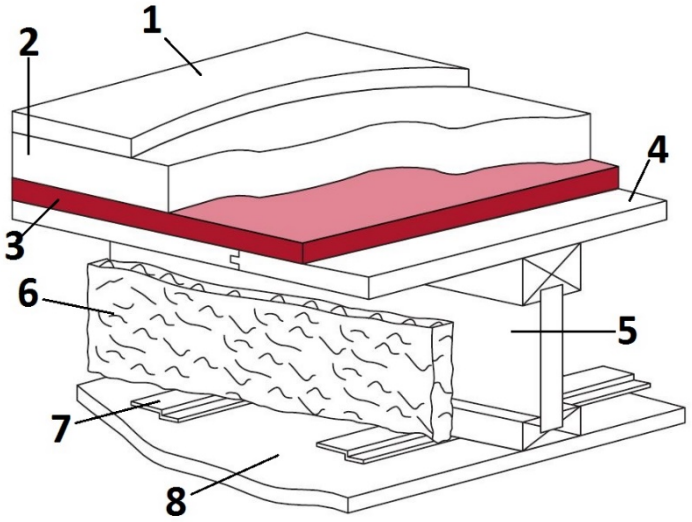
1 Floor Covering
2 Hacker Gypsum Concrete
3 Sound Mat
4 Concrete

Figure 2 – Corrugated Metal Deck



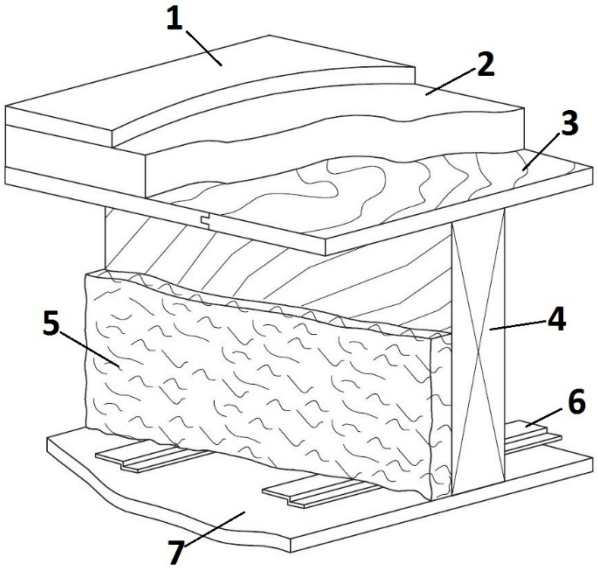
1 Floor Covering
2 Hacker Gypsum Concrete
3 Sound Mat
4 Corrugated Steel Deck
5 Structural Steel
6 Insulation Batting
7 Resilient Channel
8 Gypsum Board

Figure 3 – I-Joist with Sound Mat



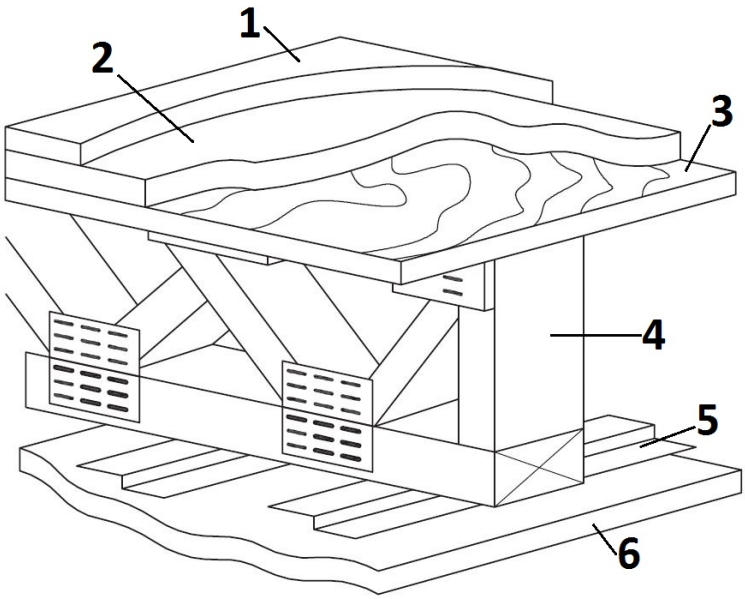
1 Floor Covering
2 Hacker Gypsum Concrete
3 Sound Mat
4 Wood Sub-Floor
5 Wood I-Joist
6 Insulation Batting
7 Resilient Channel
8 Gypsum Board

Figure 4 – Wood Joist with no Sound Mat



1 Floor Covering
2 Hacker Gypsum Concrete
3 Wood Sub-Floor
4 Wood Joist
5 Insulation Batting
6 Resilient Channel
7 Gypsum Board

Figure 5 – Open Web Truss



1 Floor Covering
2 Hacker Gypsum Concrete
3 Wood Sub-Floor
4 Open Web Truss
5 Resilient Channel
6 Gypsum Board