PRIEST & ASSOCIATES CONSULTING, LLC

TEST PLAN

Fire Resistance Testing of a 2-hour MagMatrix Wall

Assembly Based on UL Design No. U423

Test Details

Project No. 11011B

Prepared for:

Jincheng Magnesium Matrix (Jiangsu) International Trade Co LTD
3/4/5 Suite of Wang Zhuang
Yao Wang Town
Tai Xing, 225400 Jiangsu, China

July 30, 2021

4607 Verdi Road
Pleasanton, TX 78064
www.priestassociates.com

Solutions for the Building Materials Industry

1-877-505-7743 TX Office
360-957-0311 Mobile
howard.stacy@priestassociates.com

Abstract

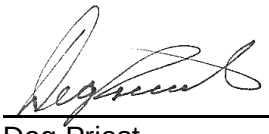
This Test Plan has been developed to describe the construction and testing details for a 2-hour loadbearing steel stud wall assembly utilizing a double layer of 12mm MagMatrix MOS Structural sheathing board installed to steel framing using a wall configuration loosely based on UL U423. The intent of this testing is for recognition in an Intertek CCRR.

Submitted by,

Howard Stacy
Senior Scientist
360-957-0311

July 30, 2021

Reviewed and Approved,



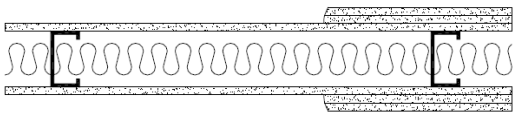
Deg Priest
President

July 30, 2021

INTRODUCTION

The following Test Plan has been devised to describe the elements of construction and assembly details for a 2-hour fire-resistance evaluation of the MagMatrix magnesium oxide oxysulfate (MOS) structural sheathing board product in a steel-framed assembly in accordance with ASTM E119/UL263. The client has requested that this test construction should be based on either UL Design U423 or U425. This plan provides for testing a U423-type construction with two layers of 12 mm MagMatrix board installed on both sides of the steel framing in the wall construction as a substitute for double layers of 5/8 in. type X gypsum wallboard (GWB). This wall system is loosely based on the construction details described in the U423 2-hour configuration. A description of the U423 design taken from the Steel Framing Alliance document "A Guide to Fire & Acoustic Data for Cold-formed Steel Floor, Wall & Roof Assemblies (February 2017)" is shown below.

The client's objective for this testing is recognition in an Intertek CCRR. Therefore, Intertek's approval of this plan is necessary before testing can proceed.

UL U423 a) USG810518 b) USG810519 c) USG811006 BXUV7	• 3 ½" x 20 MSG steel stud spaced at 24" o.c. • optional glass fiber or mineral wool insulation • optional steel resilient channels spaced 24" o.c. • gypsum board on each side (rating listed for thickness of gypsum and number of layers applied) * 80% of Design Load. ** 2" mineral wool insulation		
		45 min for 1 layer ½ in. 1 h for 1 layer ⅝ in. 1-½ h for 2 layers ½ in. * 2 h for 2 layers ⅝ in. ** 2 h for 2 layers ⅝ in. 2 h for 3 layers ½ in. 2 h for 2 layers ¾ in.	- 41[a] (RFB 2") 40[b] (NI) - - 48[c] (RFB 2") - -

The fire-resistance rating of assemblies is based on the performance of the construction when tested in accordance with ASTM E119/UL 263. The test performance is based on two criteria:

1. The ability of the assembly to support an applied load equivalent to the allowable strength design of the framing members for the duration of the fire classification period; and,
2. The ability of the assembly to resist excessive heat transfer to the unexposed surface of the construction.

The fire rating of a loadbearing wall assembly is dependent upon the degree of fire resistance protection provided by the protective membrane separating the wall framing from the fire exposure. This protection restricts heat transfer both to the framing and through to the unexposed side of the wall structure. However, the resistance to heat transfer of MgO-based panel products has been observed to be somewhat lower than that of GWB (personal test experience).

Stud Cavity Insulation Considerations

Mineral fiber (mineral wool) batt insulation is recommended for installation within the stud cavities per U423 (as indicated above). Without this type of insulation, the allowable load for the 2-hour U423 construction is restricted to 80% of design. Mineral wool (MW) batts assist in limiting heat transfer both to the lateral sides of the steel framing (to assist in maintaining the applied load – Criteria No. 1) as well as to the unexposed side of the assembly (Criteria No. 2). Typically, nom.

2.5 pcf (40 kg/m^3) MW batts filling the stud cavity have been used and recommended for this assembly. MW of greater density (nom. 6.2 pcf/100 kg/m^3) has been used in some MgO fire resistance designs. While this density of MW provides a greater degree of fire resistance protection, its use presents a more restrictive condition in terms of the versatility (and cost) of the assembly.

It should be noted that the use of MW insulation as part of the tested assembly will limit the design to MW at the tested density or greater, and insulation of types such as fiberglass or cellulosic may not be substituted.

Framing Considerations

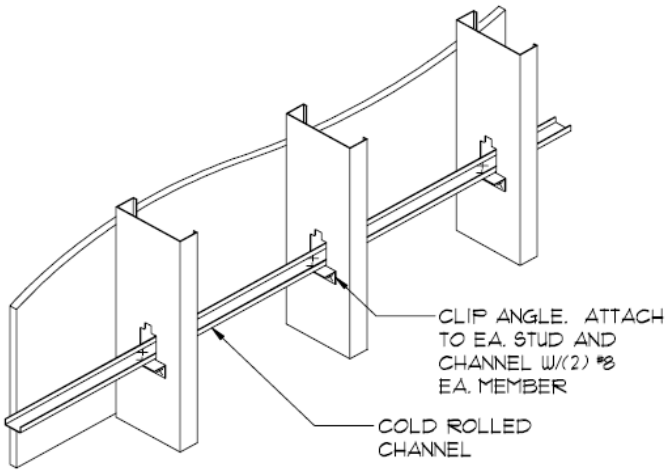
This plan includes the use of 3½ in. wide 20 GA. steel studs at a spacing of 24 in. on center (OC). UL design U423 (as well as U425) allows for the use of a minimum of 20 GA. studs at a maximum spacing of 24 in. OC. Greater stud sizes (depths) and thickness (gauge) than those tested are permitted. The indicated stud spacing is a maximum and allows for narrower spacing.

The framing for the test assembly includes nom. 4 in. wide steel backing plate to provide for the horizontal joints of the 8 ft long MagMatrix panels to be backed by framing.

Test Assembly Construction

The various elements of the assembly construction are described in the table and horizontal section provided below.

Construction Component	Description
Steel Studs and Track, Lateral Support and Horizontal Joint Backing See Figures 1 & 2.	Studs - Min. 3½ in. wide x 1⅝ in. flange, 20 GA. (350S162-33) 33 ksi, spaced 24 in. on center (OC). Studs attached to the floor and ceiling tracks with ½ in. long Type S-12 low profile self-tapping pan head steel screws on both sides of studs. Floor and Ceiling Track – 20 GA. 350T162-33, width to accommodate studs, min. 1½ in. legs. The top and bottom tracks are fastened to the supporting test frame following standard laboratory practice. Lateral Support – 16 GA. steel bracing channel, placed in the center cutout of the studs across the 10 ft width of the assembly. Steel clip angles are fastened to the studs below the channel and then attached to the channel using ½ in. No. 8 self-drilling screws. The internal bracing configuration is shown in the example below.

	 Panel Joint Backing – Minimum 20 GA. steel backing plate, 4 in. wide x 10 ft long, attached to both sides of the framing (Figures 1 & 2). The backing plate is attached to the studs with two ½ in. long Type S-12 low profile pan head screws to provide backing where horizontal butt joints occur within the field of the assembly on both sides.
Insulation	Mineral wool batts, 3½ in. thick by 24½ in. wide, nom 2.5 pcf (40 kg/m^3), friction fit within stud cavities. The ends of batts are to be staggered in each stud cavity to avoid a continuous joint across the width of the assembly.
MagMatrix Sheathing See Figures 3 – 6.	2 layers, 12mm x 1220mm (4 ft) wide x 2440mm (8 ft) long, applied vertically (centered on studs). Joints of the base layer are staggered one stud cavity on opposite sides of the studs. Vertical joints in the face layer are staggered one stud cavity. Horizontal butt joints on opposite sides are staggered front to back. Horizontal joints are backed by steel framing (backing plate). The base layer of board is attached to the framing with 1 in. long Type S-12 self-drilling bugle head drywall screws 12 in. on center (OC) at the perimeter and field. The face layer shall be attached with 1⅝ in. Type S-12 screws 12 in. OC (staggered 6 in. from base layer fasteners). Edge screws at the vertical joints shall be located ½ in. from the board edge. Screws around the perimeter of the assembly are placed nominally ¾ in. from the outside edges. Screws along the horizontal joints are located 1 in. from the board ends. Board joints are tightly fitted. Treatment of the joints and fastener heads shall be at the discretion of the client.

Instrumentation

Unexposed temperatures shall be recorded following standard test requirements with the number and location of the TCs at the discretion of Intertek.

Wall Loading

Walls will be loaded to 100% of design load as calculated by the Allowable Strength Design (ASD) method provided in the Specification for the Design of Cold-Formed Steel Structural Members (American Iron and Steel Institute). The load calculation will be by Intertek.

Testing

Testing shall be conducted using the exposure conditions of ASTM E119 for 2 hours.

Hose Stream Test

The specimen shall be subjected to the hose stream test immediately after the fire endurance exposure. If the fire resistance test assembly fails the hose stream test after the 2-hour exposure, a “hose stream retest” shall be performed on a duplicate assembly after a fire exposure of 1 hour (½ the fire endurance period, as allowed in the E119 standard).

Test Report

The test laboratory shall provide a final report.

Construction drawings are contained in the following pages.

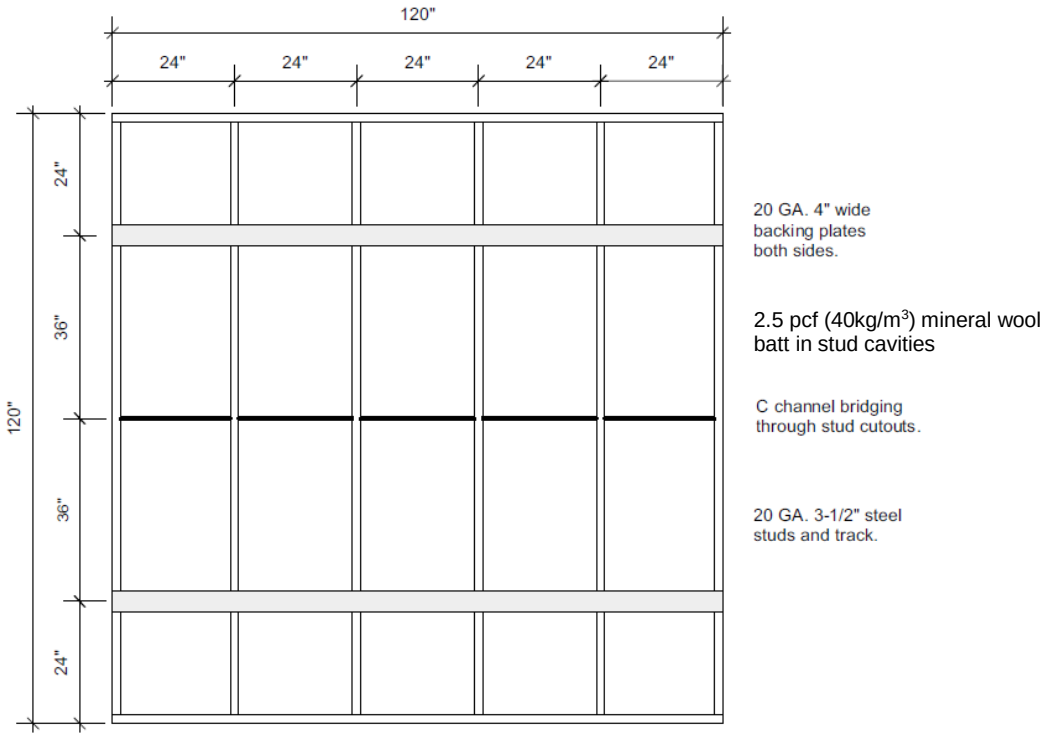


Figure 1
Steel Framing Details

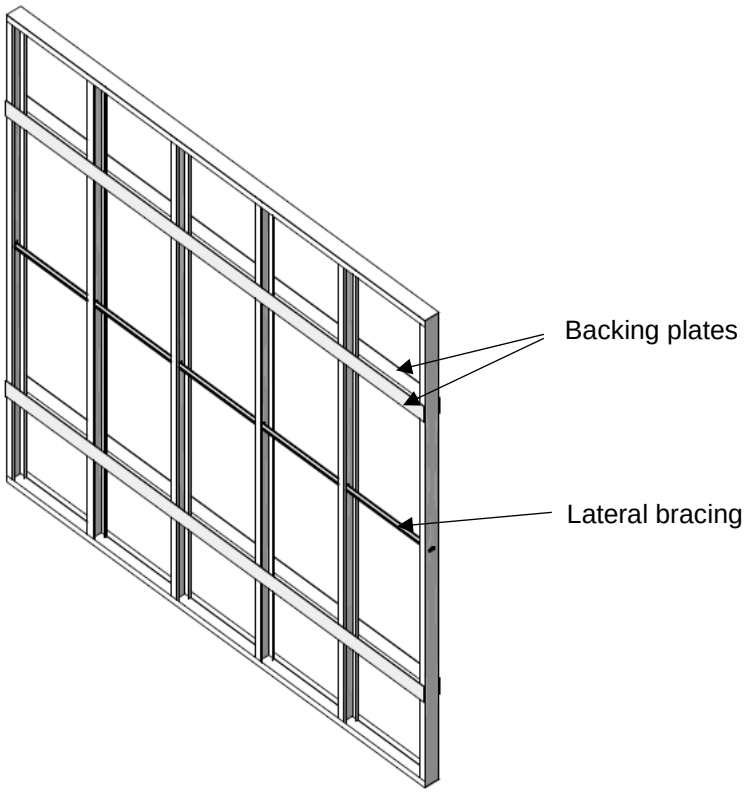


Figure 2
Right Isometric View of Framing

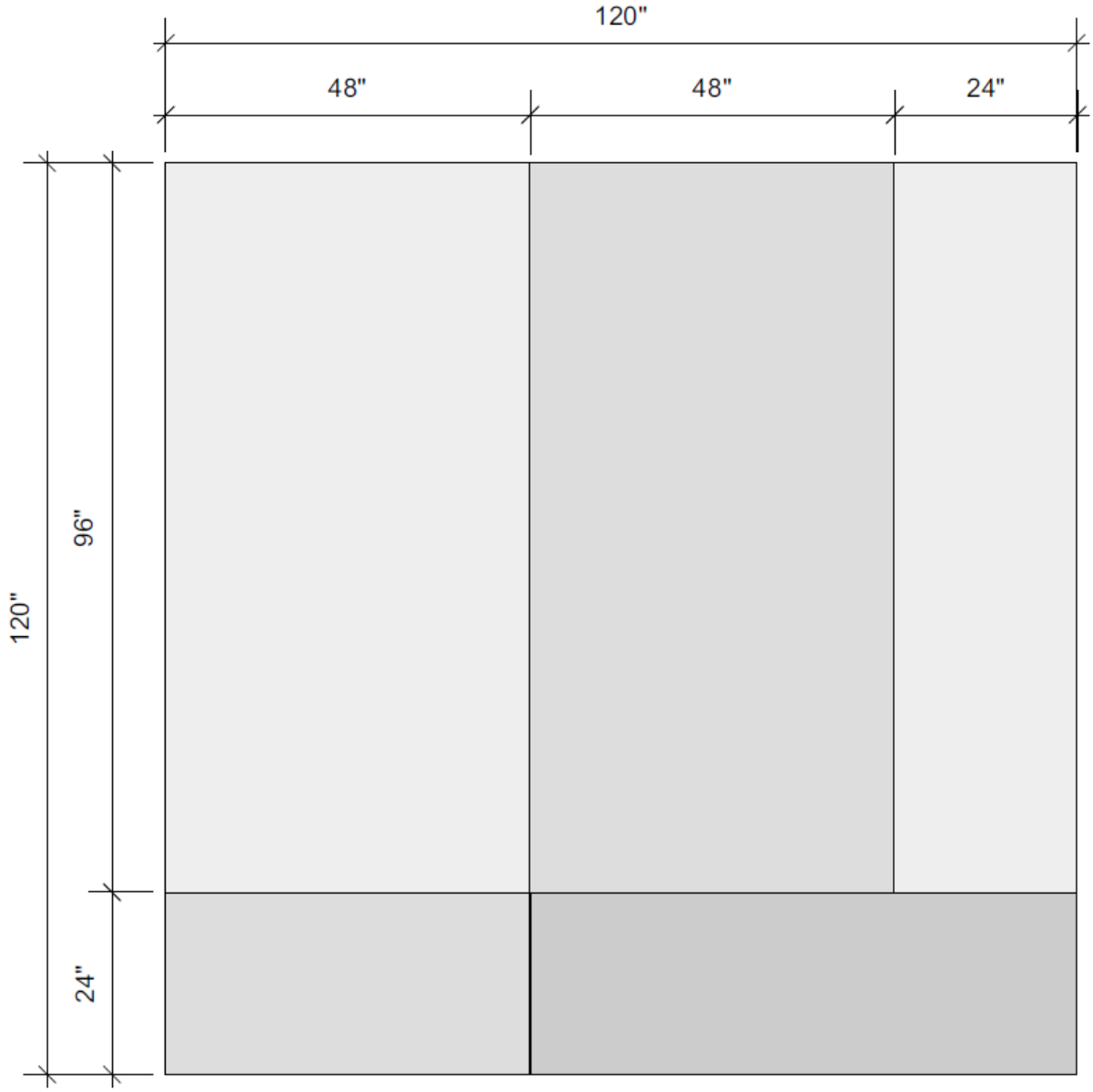


Figure 3
Base Layer 12 mm MagMatrix Board, Exposed Side

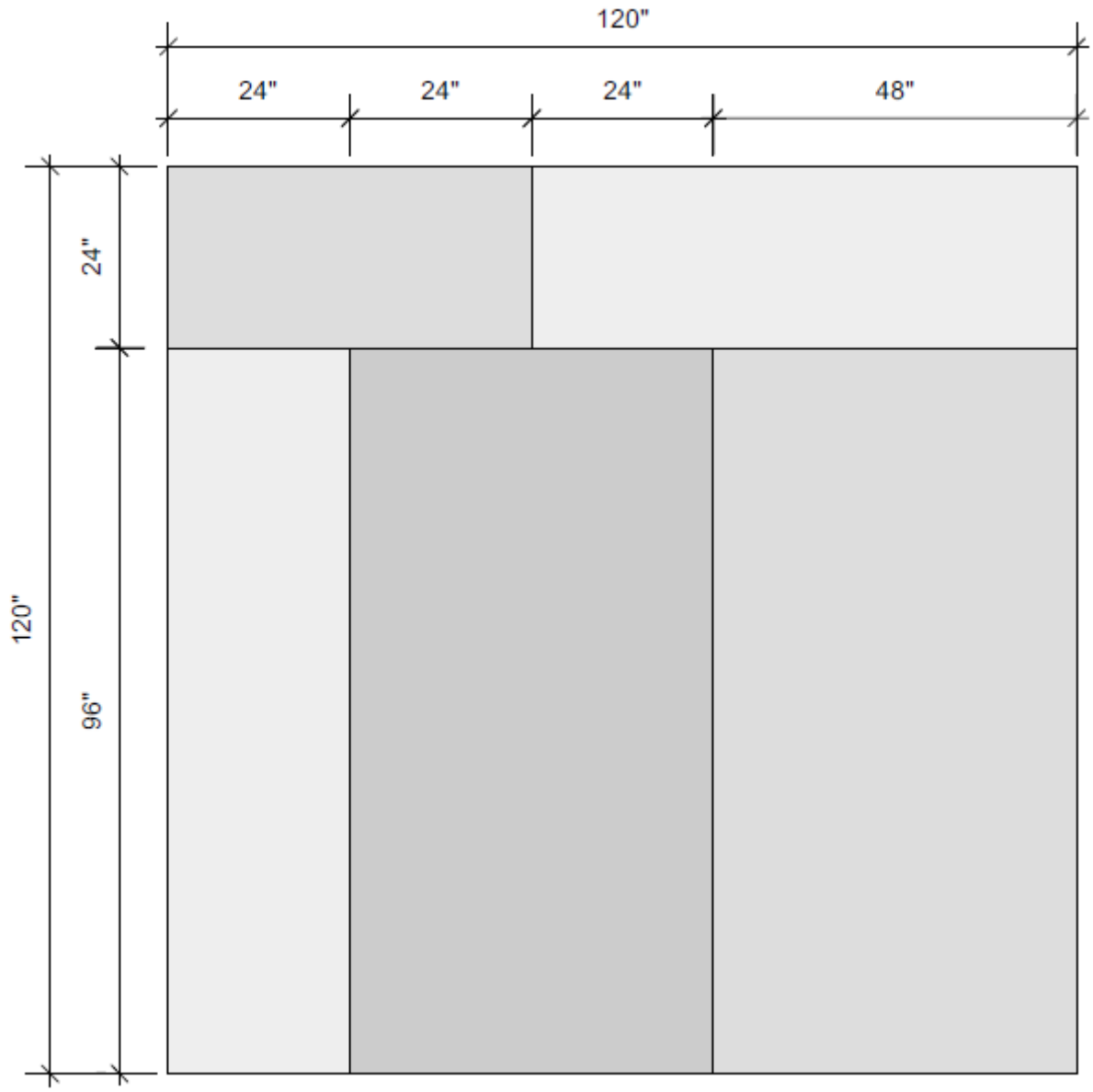


Figure 4
Face Layer 12 mm MagMatrix Board, Exposed Side

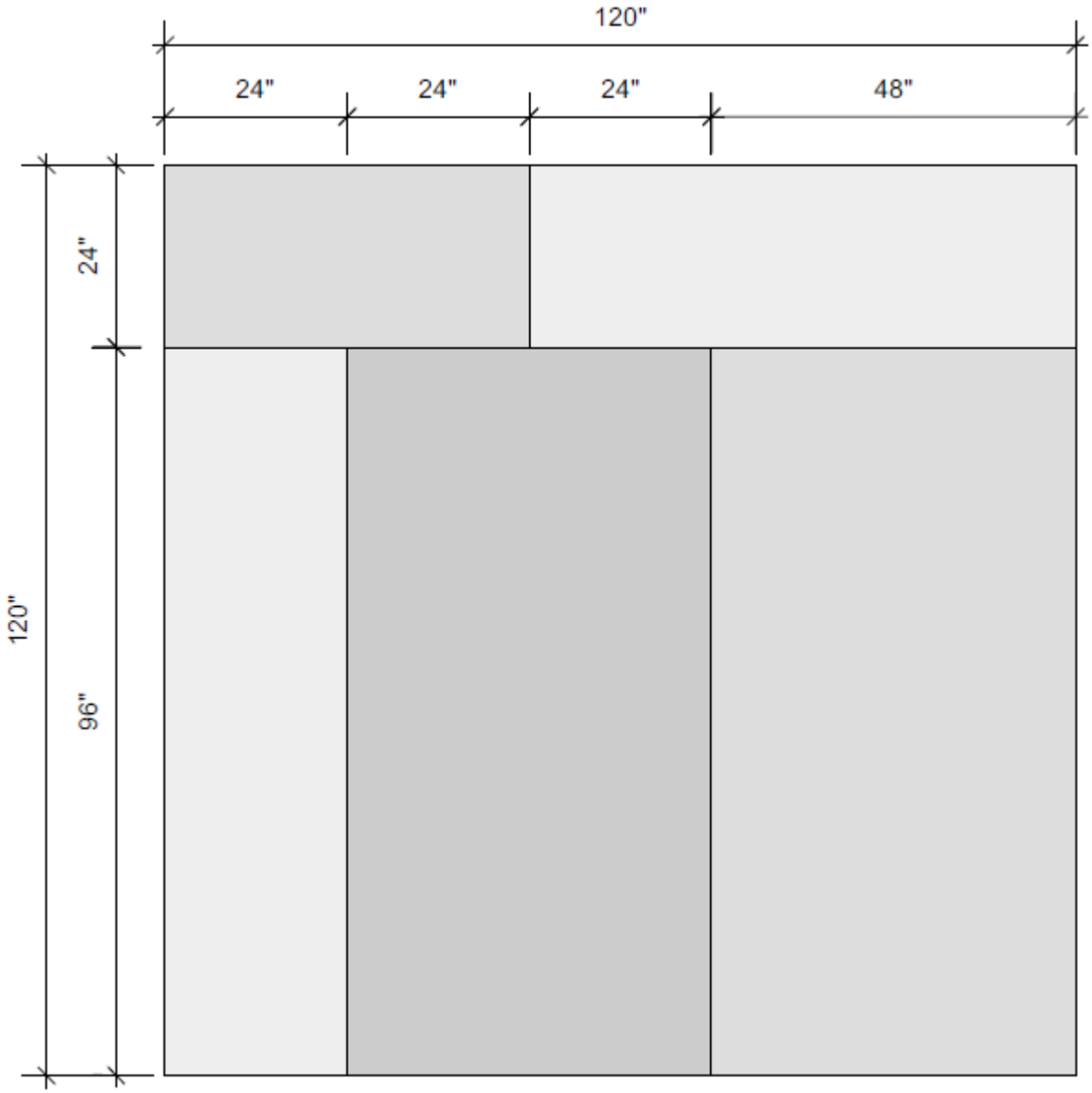


Figure 5
Base Layer 12 mm MagMatrix Board, Unexposed Side

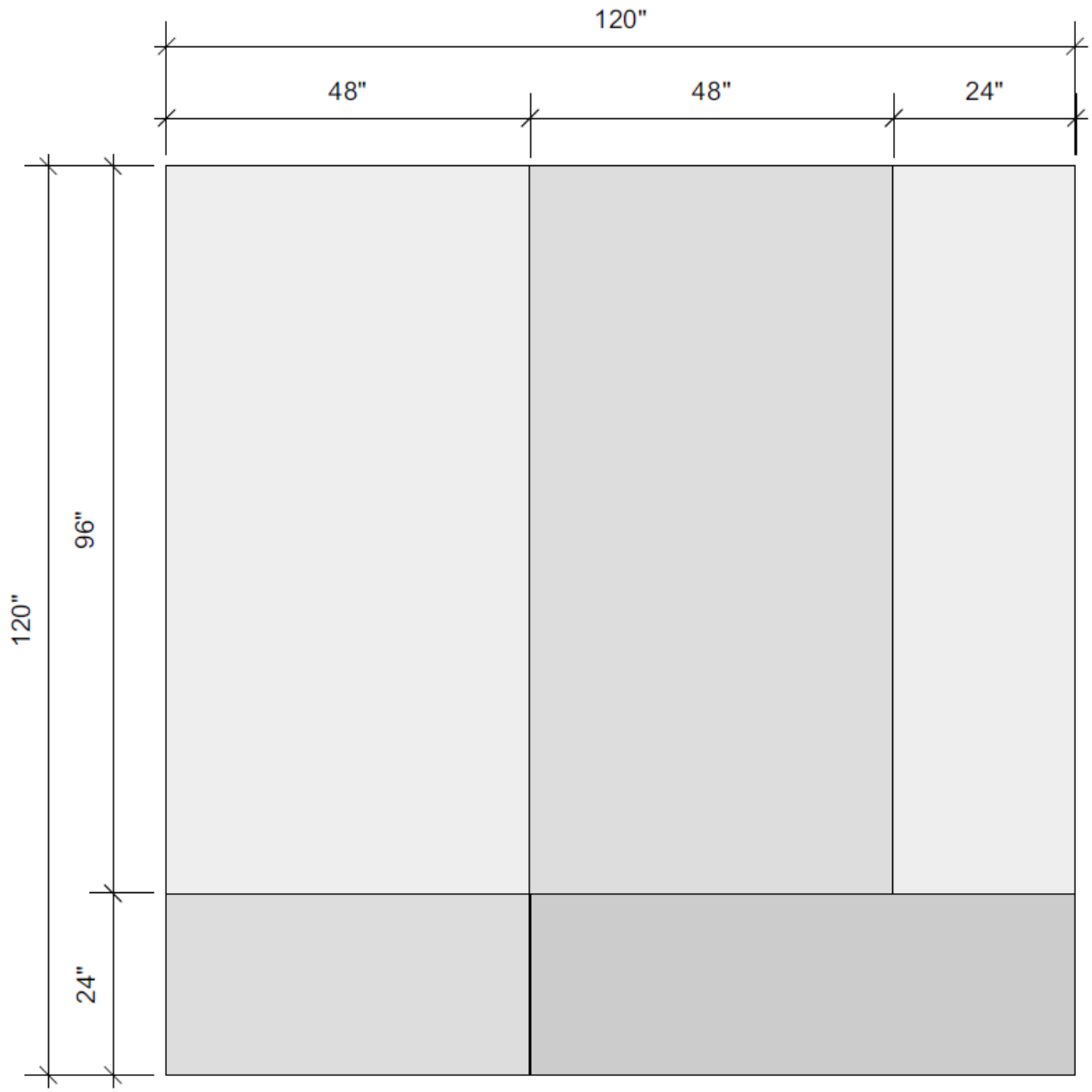


Figure 6
Face Layer 12 mm MagMatrix Board, Unexposed Side