

**North Carolina Office of the State Fire Marshal
Engineering and Building Codes Division in the Department of Insurance**

RE: Appeal of the June 29 and July)
 2, 2026, Decision by Buncombe)
 County Permits & Inspections to)
 deny use of Heatlok HFO PRO)
 Spray-Applied Polyurethane)
 Foam Plastic Insulation as an)
 alternative material for use also)
 as the fireblocking material to)
 comply with 2018 North)
 Carolina Residential Code)
 (NCRC), Section R302.11.1 and)
 as an alternative material for)
 use also as a water-resistive)
 barrier to comply with 2018)
 NCRC, Section R703.1.1 for a)
 3,100 square foot, two story,)
 one-family residential dwelling)
 of Type V wood post-frame)
 construction featuring a wall)
 assembly of horizontal 2x6)
 wood girts, corrugated metal)
 cladding, closed-cell spray)
 polyurethane foam (Heatlok)
 HFO Pro) applied to the interior)
 at the insulation stage, with)
 open-cell foam cavity fill at 153)
 Foxtail Trail, Asheville, NC)
 28806.)

OSFM DECISION

In accordance with N.C.G.S. § 143-140.1, Kevin E. Chandler of KC Construction Company, LLC has appealed the Buncombe County Permits & Inspections decision to deny use of Heatlok HFO PRO Spray-Applied Polyurethane Foam Plastic Insulation as an alternative material for use also as the fireblocking material to comply with 2018 NCRC, Section R302.11.1 and as an alternative material for use also as a water-resistive barrier to comply with 2018 NCRC, Section R703.1.1 for a 3,100 square foot, two story, one-family residential dwelling of Type V wood post-frame construction featuring a wall assembly of horizontal 2x6 wood girts, corrugated metal cladding, closed-cell spray polyurethane foam (Heatlok HFO Pro) applied to the interior at the insulation stage, with open-cell foam cavity fill at 153 Foxtail Trail, Asheville, NC 28806.

In the event of a dispute between a local authority having jurisdiction and the designer or owner-representative regarding alternative designs and construction, and notwithstanding any other section within law, N.C.G.S. § 143-140.1 allows for appeals by the designer or owner-representative on matters pertaining to alternative design construction or methods. N.C.G.S. § 143-140.1 further states that this appeal shall be heard by the Engineering and Building Codes Division within the North Carolina Office of the State Fire Marshal (OSFM).

PARTIES

Appellant: Kevin E. Chandler
KC Construction Company, LLC
188 Toronto Trail
Clyde, NC 28721

Appellee: Buncombe County Permits & Inspections
35 Woodfin Street
Asheville, NC 28801

BACKGROUND

On June 29 and July 2, 2026, the appellee notified the appellant via two separate letters to deny use of Heatlok HFO PRO Spray-Applied Polyurethane Foam Plastic Insulation as an alternative material for use also as the fireblocking material to comply with 2018 NCRC, Section R302.11.1 and as an alternative material for use also as a water-resistive barrier to comply with 2018 NCRC, Section R703.1.1 for a 3,100 square foot, two story, one-family residential dwelling of Type V wood post-frame construction featuring a wall assembly of horizontal 2x6 wood girts, corrugated metal cladding, closed-cell spray polyurethane foam (Heatlok HFO Pro) applied to the interior at the insulation stage, with open-cell foam cavity fill at 153 Foxtail Trail, Asheville, NC 2880.

On August 12, 2026, the appellant submitted an appeal to OSFM in accordance with N.C.G.S. § 143-140.1 requesting approval of the use of Heatlok HFO PRO Spray-Applied Polyurethane Foam Plastic Insulation as an alternative material for use also as the fireblocking material to comply with 2018 NCRC, Section R302.11.1 and as an alternative material for use also as a water-resistive barrier to comply with 2018 NCRC, Section R703.1.1 for a 3,100 square foot, two story, one-family residential dwelling of Type V wood post-frame construction featuring a wall assembly of horizontal 2x6 wood girts, corrugated metal cladding, closed-cell spray polyurethane foam (Heatlok HFO Pro) applied to the interior at the insulation stage, with open-cell foam cavity fill at 153 Foxtail Trail, Asheville, NC 28806.

ISSUE RAISED IN APPEAL

The appellant is appealing the appellee's decision to deny the use of Heatlok HFO PRO Spray-Applied Polyurethane Foam Plastic Insulation as an alternative material for use also as the fireblocking material to comply with 2018 NCRC, Section R302.11.1 and as an alternative material for use also as a water-resistive barrier to comply with 2018 NCRC, Section R703.1.1 for a 3,100 square foot, two story, one-family residential dwelling of Type V wood post-frame construction featuring a wall assembly of horizontal 2x6 wood girts, corrugated metal cladding, closed-cell spray polyurethane foam (Heatlok HFO Pro) applied

to the interior at the insulation stage, with open-cell foam cavity fill at 153 Foxtail Trail, Asheville, NC 28806.

The appellants' appeal reads in most relevant part as follows:

'Date of original filing: July 9, 2026 (Notice of Appeal, acknowledged by NCDOI July 10, 2026). This form is submitted in support of that filing and does not initiate a new appeal. Building: One-family residential dwelling. Wood post-frame construction, Type V. Approximately 3,100 square feet, two stories. Permitted under the 2018 North Carolina Residential Code. Wall assembly: horizontal 2x6 wood girts, corrugated metal cladding, closed-cell spray polyurethane foam (Heatlok HFO Pro) applied to the interior at the insulation stage, with open-cell foam cavity fill. Location: 153 Foxtail Trail, Asheville, NC 28806. Buncombe County. Permit BLD2025-01146. Owner of record: Paden Brunault (co-appellant). Contractor of record: KC Construction Company LLC, NC GC License #82407. Decision appealed: Written determination of Buncombe County Permits and Inspections dated July 2, 2026, issued under Section 105 of the NC Administrative Code and Policies (review of alternative material, design, or method), declining to approve the proposed wall assembly with respect to the fireblocking requirements of R302.11. Supporting information attached.

Traditional wood fireblocking is installed at all interlevel separations required by R302.11 and is ready for inspection. The closed-cell foam is not proposed in place of that fireblocking. The only condition in dispute is the void at the corrugation profile where the metal panel meets the framing, which the closed-cell application seals at the insulation stage, leaving no continuous concealed draft opening — the condition R302.11 exists to prevent. That material cannot be installed until the framing inspection passes; the Exhibit 4 photographs show the assembly at the framing stage, which is the only condition that can exist before that material is applied. Heatlok HFO Pro is a tested air barrier material: Intertek Report L4520.01-801-44 R0 measured air leakage under ASTM E2357 at 0.0024 L/s·m². R302.11.1 accepts air-permeable unfaced fiberglass batts as fireblocking. The determination also cites ESR-4073, which evaluates Heatlok HFO High Lift; the installed product is Heatlok HFO Pro under IAPMO UES ER-565, and quotes ER-565 Sec. 1.0 without Sec. 3.0, which covers Type V and IRC dwellings. Relief requested: a finding of equivalent protection under 11 NCAC 08 .1504(b), and confirmation that the sealing of the corrugation profile is verifiable at the insulation inspection. See attached.'

....

'The determination cites ESR-4073, which evaluates Heatlok HFO High Lift; the installed product is Heatlok HFO Pro under IAPMO UES ER-565. It states ASTM E331 approvals are not listed; Intertek Report L4520.01-801-44 R0 is an ASTM E331 test of the installed product at 15 psf, 120 minutes, no water penetration. R703.1.1 Exception 2 permits a water-resistive barrier demonstrated by testing in lieu of a prescriptive product; that report is the demonstration. The county inspector confirmed this pathway in writing on February 17, 2026. The determination also quotes ER-565 Sec. 1.0 without Sec. 3.0, which covers Type V and IRC dwellings. Relief requested: a finding of equivalent protection under 11 NCAC 08 .1504(b) and an order overruling the determination. See attached.'

FINDINGS

Based on information submitted by the appellant, the undersigned makes the following findings:

Code sections noted in this letter refer to the 2018 edition of the NC Residential Code (NCRC) unless otherwise noted.

Code Analysis: Section R302.11 requires fireblocking in combustible construction to cut off vertical and horizontal concealed draft openings and to form an effective fire barrier between stories and between the top story and the roof space. The locations listed in the section identify where concealed spaces, or interconnections between concealed spaces, may permit the passage of flame and products of combustion. Section R302.11.1 lists the materials that may be used for fireblocking. Specifically, Item 7 permits batts or blankets of mineral wool or glass fiber, as well as other approved materials, when they are securely retained in place. Where a material is relied upon to provide fireblocking, it must be a material permitted by Section R302.11.1 or be approved for that use under the applicable code provisions. Section R703.1.1 Exception 2 permits an alternative to the requirements for a means of drainage and to Sections R703.2 and R703.4 only where the exterior-wall-envelope design has been demonstrated, through ASTM E331 testing, to resist wind-driven rain. To use this exception, the constructed exterior-wall-envelope assembly must conform to the tested assembly, including the materials, configuration, joints, penetrations, opening perimeters, and intersections with dissimilar materials that affect the assembly's resistance to wind-driven rain. Any variation from the tested assembly that affects those features must be supported by evidence demonstrating equivalent resistance to wind-driven rain. Section 105 of the 2018 NC Administrative Code and Policies (NCACP) describes the process by which alternate materials, design or methods of construction may be approved by the code enforcement official for a specific project.

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R302.11 Fireblocking. In combustible construction, fireblocking shall be provided to cut off both vertical and horizontal concealed draft openings and to form an effective fire barrier between stories, and between a top *story* and the roof space.

Fireblocking shall be provided in wood-framed construction in the following locations:

1. In concealed spaces of stud walls and partitions, as follows:
 - 1.1. Vertically at the ceiling and floor levels.
 - 1.2. Horizontally at intervals not exceeding 10 feet (3048 mm) in furred spaces and parallel rows of studs or staggered studs.
2. At interconnections between concealed vertical and horizontal spaces such as occur at soffits, drop ceilings and cove ceilings.
3. In concealed spaces between stair stringers at the top and bottom of the run. Enclosed spaces under stairs shall comply with Section R302.7.
4. At openings around vents, pipes, ducts, cables and wires at ceiling and floor level, with an *approved* material to resist the free passage of flame and products of combustion. The material filling this annular space shall not be required to meet the ASTM E136 requirements.
5. For the fireblocking of chimneys and fireplaces, see Section R1003.19.

6. Fireblocking of cornices of a two-family dwelling is required at the line of *dwelling* unit separation.

R302.11.1 Fireblocking materials. Except as provided in Section R302.11, Item 4, fireblocking shall consist of the following materials.

1. Two-inch (51 mm) nominal lumber.
2. Two thicknesses of 1-inch (25.4 mm) nominal lumber with broken lap joints.
3. One thickness of 23/32-inch (18.3 mm) wood structural panels with joints backed by 23/32-inch (18.3 mm) wood structural panels.
4. One thickness of 3/4-inch (19.1 mm) particleboard with joints backed by 3/4-inch (19.1 mm) particleboard.
5. One-half-inch (12.7 mm) gypsum board.
6. One-quarter-inch (6.4 mm) cement-based millboard.
7. Batts or blankets of mineral wool or glass fiber or other *approved* materials installed in such a manner as to be securely retained in place.
8. Cellulose insulation installed as tested in accordance with ASTM E119 or UL 263, for the specific application.

....

R703.1.1 Water resistance. The exterior wall envelope shall be designed and constructed in a manner that prevents the accumulation of water within the wall assembly by providing a water-resistant barrier behind the exterior veneer as required by Section R703.2 and a means of draining to the exterior water that enters the assembly. Protection against condensation in the exterior wall assembly shall be provided in accordance with Section R702.7 of this code.

Exceptions:

1. A weather-resistant exterior wall envelope shall not be required over concrete or masonry walls designed in accordance with Chapter 6 and flashed in accordance with Section R703.4 or R703.8.
2. Compliance with the requirements for a means of drainage, and the requirements of Sections R703.2 and R703.4, shall not be required for an exterior wall envelope that has been demonstrated to resist wind-driven rain through testing of the exterior wall envelope, including joints, penetrations and intersections with dissimilar materials, in accordance with ASTM E331 under the following conditions:
 - 2.1. Exterior wall envelope test assemblies shall include at least one opening, one control joint, one wall/eave interface and one wall sill. All tested openings and penetrations shall be representative of the intended end-use configuration.
 - 2.2. Exterior wall envelope test assemblies shall be at least 4 feet by 8 feet (1219 mm by 2438 mm) in size.

2.3. Exterior wall assemblies shall be tested at a minimum differential pressure of 6.24 pounds per square foot (299 Pa).

2.4. Exterior wall envelope assemblies shall be subjected to the minimum test exposure for a minimum of 2 hours.

The exterior wall envelope design shall be considered to resist wind-driven rain where the results of testing indicate that water did not penetrate control joints in the exterior wall envelope, joints at the perimeter of openings, penetration or intersections of terminations with dissimilar materials.

....

SECTION 105

ALTERNATE MATERIAL, DESIGN OR METHODS

105.1 Approval. The provisions of this code are intended to allow the use of any alternate material, design or method of construction, provided that the alternate has been approved by the code enforcement official. An alternative material, design or method of construction shall be approved where the code enforcement official finds that the proposed alternative material, design or method of construction complies with the intent and provisions of the technical codes.

Commentary: The technical codes are not intended to inhibit innovative ideas or technological advances. A comprehensive regulatory document, such as the North Carolina Building Codes, cannot envision and then address all future innovations in the industry. As a result, a performance code must be applicable to and provide a basis for the approval of an increasing number of newly developed, innovative materials, systems and methods for which no code text or referenced standards yet exist. The fact that a material, product or method of construction is not addressed in the technical codes is not an indication that such material, product or method is intended to be prohibited. The code enforcement official is expected to apply sound technical judgment in accepting materials, systems or methods that, while not anticipated by the drafters of the current code text, can be demonstrated to offer equivalent performance. By virtue of its text, the code regulates new and innovative construction practices while addressing the relative safety of building occupants. The code enforcement official is responsible for determining if a requested alternative provides the equivalent level of protection of public health, safety and welfare as required by the code.

105.2 Tests or analysis. Whenever there is insufficient evidence of compliance with the provisions of the technical codes, or evidence that a material, design or method does not conform to the requirements of the technical codes, or in order to substantiate claims for an alternative material, design or method, the code enforcement official shall have the authority to require tests as evidence of compliance to be made at no expense to the authority having jurisdiction. Test methods shall be as specified in the technical codes or by other recognized test standards. In the absence of recognized and accepted test methods, the code enforcement official shall approve the testing procedures.

....

CONCLUSIONS

Based on the forgoing findings of fact, the following conclusions are made:

1. The proposed use of Heatlok HFO PRO Spray-Applied Polyurethane Foam Plastic Insulation as an alternative material for use also as the fireblocking material to comply with 2018 NCRC, Section R302.11.1, #7 is approved as per the manufacturer's letter dated 3/3/26, UES evaluation report

#365 noting compliance with the International Building, Residential and Energy Conservation Codes from 2009 through 2021 and the Intertek Test Report attached to this response letter.

2. The proposed use of Heatlok HFO PRO Spray-Applied Polyurethane Foam Plastic Insulation as an alternative material for use also as a water-resistive barrier to comply with 2018 NCRC, Section R703.1.1, #2 is approved as per the manufacturer's letter dated 3/3/26 UES evaluation report #365 noting compliance with the International Building, Residential and Energy Conservation Codes from 2009 through 2021 and the Intertek Test Report attached to this response letter.
3. This product can meet the code intent for the requirements for fireblocking and water-resistive barrier as an alternative material if the foam insulation can be applied between the wood studs and the metal decking and the entire cavity including the gaps between the metal decking and the wood studs can be completely sealed in a manner that meets Section R302.11.1, Section R703.1.1 and the products manufacturer's installation instructions, listing and labeling.

APPEAL DECISION

Based on a careful review of additional information provided by the appellant and appellee during the ensuing investigation by OSFM after the filing of this appeal by the appellant, it is the opinion of OSFM that the use of Heatlok HFO PRO Spray-Applied Polyurethane Foam Plastic Insulation as an alternative material for use also as the fireblocking material to comply with 2018 NCRC, Section R302.11.1 and as an alternative material for use also as a water-resistive barrier to comply with 2018 NCRC, Section R703.1.1 for a 3,100 square foot, two story, one-family residential dwelling of Type V wood post-frame construction featuring a wall assembly of horizontal 2x6 wood girts, corrugated metal cladding, closed-cell spray polyurethane foam (Heatlok HFO Pro) applied to the interior at the insulation stage, with open-cell foam cavity fill at 153 Foxtail Trail, Asheville, NC 28806 is not approved under 2018 NCACP, Section 105 for the proposed installation method by the appellant.

This 14th day of September 2026.



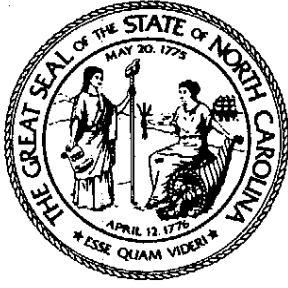
David Rittlinger, PE, LEED AP
Division Chief – Codes & Interpretations
North Carolina Office of State Fire Marshal

FURTHER APPEAL RIGHTS

The appellant and appellee have the right to appeal this decision to the NC Residential Code Council or Wake County Superior Court. Please refer to N.C.G.S. § 143-140, N.C.G.S. § 143-141 and the NC Administrative Code and Policies, Section 202.9 for further appeal rights. In accordance with N.C.G.S. § 143-141, you have 30 days in which to appeal this decision to the NC Residential Code Council or Wake County Superior Court.

Cc:

Jason R. Rogers, Director, Buncombe County Permits & Inspections, jason.rogers@buncombenc.gov
Nathan Childs, NCDOJ, counsel for NC Building Code Council, nchilds@ncdoj.gov
Nicki Shaffer, NCDOJ, counsel for NC Residential Code Council, wshaffer@ncdoj.gov



APPENDIX E
APPEALS
NORTH CAROLINA
BUILDING CODE COUNCIL
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Raleigh, North Carolina 27610
(919) 647-0008
david.rittlinger@ncdoi.gov

GS 153A-374, GS 160A-434
 Formal Interpretation by NCDOI _____
 Appeal of Local Decision to NCDOI _____

APPEAL TO NCDOI/NCBCC
 Hearing Date _____ / _____ / _____
 GS 143-140, GS 143-141
 Appeal of Local Decision to NCBCC _____
 Appeal of NCDOI Decision to NCBCC _____

APPELLANT Kyle E. Chandler.
REPRESENTING KC Construction Company LLC - NC GC license #82407
ADDRESS 188 Toronto Trail
CITY Clyde
STATE NC. **ZIP** 28721
E-MAIL Builtbykc@gmail.com **FAX** () -

2018 NCRC R302.11.1 Item 7 and R316.6 NC Admin Code Sec. 105; G.S. 143-140.1; 11 NCAC 08
North Carolina State Building Code, Volume - **Section** 1501- 1505

REQUEST ONE: ☐ Formal Interpretation by NCDOI ☐ Appeal of Local Decision to NCBCC
☒ Appeal of Local Decision to NCDOI ☐ Appeal of NCDOI Decision to NCBCC

Type or print. Include all background information as required by the referenced General Statutes and the attached policies. Attach additional supporting information.

Date of original filing: July 9, 2026 (Notice of Appeal, acknowledged by NCDOI July 10, 2026). This form is submitted in support of that filing and does not initiate a new appeal. Building: One-family residential dwelling. Wood post-frame construction, Type V. Approximately 3,100 square feet, two stories. Permitted under the 2018 North Carolina Residential Code. Wall assembly: horizontal 2x6 wood girts, corrugated metal cladding, closed-cell spray polyurethane foam (Heatlok HFO Pro) applied to the interior at the insulation stage, with open-cell foam cavity fill. Location: 153 Foxtail Trail, Asheville, NC 28806. Buncombe County. Permit BLD2025-01146. Owner of record: Paden Brunault (co-appellant). Contractor of record: KC Construction Company LLC, NC GC License #82407. Decision appealed: Written determination of Buncombe County Permits and Inspections dated July 2, 2026, issued under Section 105 of the NC Administrative Code and Policies (review of alternative material, design, or method), declining to approve the proposed wall assembly with respect to the fireblocking requirements of R302.11. Supporting information attached.

REASON:

Traditional wood fireblocking is installed at all interlevel separations required by R302.11 and is ready for inspection. The closed-cell foam is not proposed in place of that fireblocking. The only condition in dispute is the void at the corrugation profile where the metal panel meets the framing, which the closed-cell application seals at the insulation stage, leaving no continuous concealed draft opening — the condition R302.11 exists to prevent. That material cannot be installed until the framing inspection passes; the Exhibit 4 photographs show the assembly at the framing stage, which is the only condition that can exist before that material is applied. Heatlok HFO Pro is a tested air barrier material: Intertek Report L4520.01-801-44 R0 measured air leakage under ASTM E2357 at 0.0024 L/s·m². R302.11.1 accepts air-permeable unfaced fiberglass batts as fireblocking. The determination also cites ESR-4073, which evaluates Heatlok HFO High Lift; the installed product is Heatlok HFO Pro under IAPMO UES ER-565, and quotes ER-565 Sec. 1.0 without Sec. 3.0, which covers Type V and IRC dwellings. Relief requested: a finding of equivalent protection under 11 NCAC 08 . 1504(b), and confirmation that the sealing of the corrugation profile is verifiable at the insulation inspection. See attached

DocuSigned by:
 Signature _____
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DATE: 8/12/2026

APPEAL TO NCDOI/NCBCC

FORM 3/14/17

202.9 Appeals

202.9.1 Engineering Division. A written technical interpretation shall be provided as specified in Section 203.2.1.2. Any person may appeal in writing an order, decision, or determination pertaining to the code or any state building law by filing written notice with the Commissioner of Insurance or his designee within ten (10) days after the order, decision, or determination. A copy of the appeal shall be furnished to each party.
(General Statutes 143-140, 153A-374 and 160A-434)

203.2.1 Interpretations

203.2.1.1 Informal Interpretations. The Engineering Division shall provide informal interpretations on code related matters either by e-mail, letter or telephone. These informal interpretations may be accepted by the local code enforcement official or party requesting the interpretation. Either party may request a formal interpretation of the code.

203.2.1.2 Formal Interpretations. Any person may request in writing a formal interpretation of the code. The request shall be addressed to the Chief Code Consultant for the Department of Insurance. The request shall be specific and shall reference the code sections in question. All formal interpretations shall be in writing. A formal interpretation shall be binding on all parties unless appealed to the Building Code Council as specified in Section 201.9.2. Formal interpretations determined to be of a general nature may be posted on the Department website. (General Statute 143-140)

203.2.2 Appeals. Any person may appeal in writing an order, decision, or determination of a code enforcement official pertaining to the code or any state building law. The appeal shall be addressed to the Chief Engineer for the Department of Insurance by filing written notice within ten (10) days after the order, decision, or determination. The appeal shall contain the type and size of the building in question, the location of the building, and shall reference the code sections in question. The decision shall be in writing and shall set forth the facts found. The decision rendered shall be based on the technical provisions of the code, public health and safety and shall be construed liberally to those ends. A decision shall be binding on all parties unless appealed to the Building Code Council as specified in Section 201.9.2. A copy of the appeal and written decision shall be furnished to each party. (General Statutes 153A-374 and 160A-434)

202.9.2 Building Code Council. The Building Code Council shall hear appeals from the decisions of State enforcement agencies relating to any matter related to the code. Any person wishing to appeal a decision of a State enforcement agency to the Building Code Council shall give written notice of appeal as follows:

202.9.2.1 Twenty one (21) copies including an original of the Notice of Appeal shall be filed with the Building Code Council c/o NC Department of Insurance, Engineering Division, 325 North Salisbury Street, Room 5_44, Raleigh, NC 27603 and one (1) copy shall be filed with the State enforcement agency from which the appeal is taken.

202.9.2.2 The Notice of Appeal shall be received no later than thirty (30) days from the date of the decision of the State enforcement agency.

202.9.2.3 The Notice of Appeal shall be legibly printed, typewritten or copied and shall contain the following:

- (1) Name, address of the party or parties requesting the appeal.
- (2) The name of the State enforcement agency, the date of the decision from which the appeal is taken, and a copy of the written decision received from the enforcement agency.
- (3) The decision from which the appeal is taken shall be set forth in full in the Notice of Appeal or a copy of the decision shall be attached to all copies of the Notice of Appeal.
- (4) The contentions and allegations of fact must be set forth in full in a clear and concise manner with reference to the sections of the code in controversy.
- (5) The original Notice of Appeal shall be signed by the party or parties filing appeal.
- (6) The Notice of Appeal shall be received by the first day of the month prior to the Building Code Council's quarterly scheduled meeting in order to be placed on the agenda for that meeting. The Chairman may schedule a special meeting to hear an appeal.

202.9.2.4 Upon the proper filing of the Notice of Appeal, the Building Code Council Secretary shall forward one (1) copy of the Notice of Appeal to each member of the Building Code Council. The Chairman may appoint a Hearing Committee to hear appeals. The Secretary shall send notice in writing to the party or parties requesting an appeal and to the Building Code Council Hearing Committee members at least fifteen (15) days prior to the Hearing Committee meeting. A written decision of the Hearing Committee meeting shall be provided to all Building Code Council Members. The actions of the Hearing Committee shall be final, unless appealed to the full Building Code Council in writing within 30 days of the Hearing Committee's action. If a Hearing Committee consists of at least seven Council members, it will constitute a quorum of the full Council. Further appeals shall be as specified in Section 202.9.3.

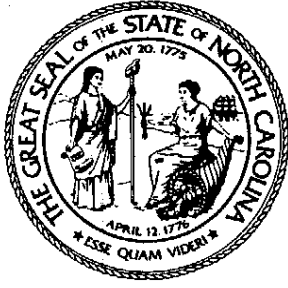
202.9.2.5 The Building Code Council shall, upon a motion of the State enforcement agency or on its own motion, dismiss appeals for the following reasons:

- (1) Not pursued by the appellant or withdrawn;
- (2) Appeal not filed in accordance with these rules; or
- (3) Lack of jurisdiction.

202.9.2.6 When the Building Code Council finds that a State enforcement agency was in error in its interpretation of the code, the Building Code Council shall remand the case to the agency with instructions to take such actions as the Building Code Council directs. When the Building Code Council finds on appeal that materials or methods of construction proposed are equivalent to those required by the code, the Building Code Council shall remand the case to the State enforcement agency with instructions to permit the use of such materials or methods of construction. The Building Code Council shall immediately initiate procedures for amending the code to permit the use of such materials or methods of construction.

202.9.2.7 The Building Code Council shall provide a written decision setting forth the findings of fact and the Building Code Council's conclusions to each party or parties filing the appeal and to the State enforcement agency from which the appeal was taken.

202.9.3 Superior Court. Whenever any person desires to appeal a decision of the Building Code Council or a decision of a State or local enforcement agency, he may appeal either to the Wake County Superior Court or the Superior Court of the county in which the proposed building is to be situated in accordance with the provisions of Chapter 150B of the General Statutes.
(General Statute 143-141(d))



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BUILDING CODE COUNCIL
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david.rittlinger@ncdoi.gov

GS 153A-374, GS 160A-434
 Formal Interpretation by NCDOI _____
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APPEAL TO NCDOI/NCBCC
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APPELLANT Kyle Chandler
REPRESENTING KC Construction Company LLC- NC GC License #82407
ADDRESS 188 Toronto Trail
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STATE NC **ZIP** _____
E-MAIL Builtbykc@gmail.com **FAX** (____) ____ - ____

North Carolina State Building Code, Volume _____ - Section _____
2018 NCRC R703.1.1 Exception 2 NC Admin Code Sec. 105; G.S. 143-140.1; 11 NCAC 08 1501- 1505

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Date of original filing: July 9, 2026 (Notice of Appeal, acknowledged by NCDOI July 10, 2026). This form is submitted in support of that filing and does not initiate a new appeal. Building: One-family residential dwelling. Wood post-frame construction, Type V. Approximately 3,100 square feet, two stories. Permitted under the 2018 North Carolina Residential Code. Wall assembly: horizontal 2x6 wood girts, corrugated metal cladding, closed-cell spray polyurethane foam (Heatlok HFO Pro) applied to the interior at the insulation stage, with open-cell foam cavity fill. Location: 153 Foxtail Trail, Asheville, NC 28806. Buncombe County. Permit BLD2025-01146. Owner of record: Paden Brunault (co-appellant). Contractor of record: KC Construction Company LLC, NC GC License #82407. Decision appealed: Written determination of Buncombe County Permits and Inspections dated June 29, 2026, issued under Section 105 of the NC Administrative Code and Policies (review of alternative material, design, or method), declining to accept the proposed water-resistive barrier assembly. Supporting information attached.

REASON:

The determination cites ESR-4073, which evaluates Heatlok HFO High Lift; the installed product is Heatlok HFO Pro under IAPMO UES ER-565. It states ASTM E331 approvals are not listed; Intertek Report L4520.01-801-44 R0 is an ASTM E331 test of the installed product at 15 psf, 120 minutes, no water penetration. R703.1.1 Exception 2 permits a water-resistive barrier demonstrated by testing in lieu of a prescriptive product; that report is the demonstration. The county inspector confirmed this pathway in writing on February 17, 2026. The determination also quotes ER-565 Sec. 1.0 without Sec. 3.0, which covers Type V and IRC dwellings. Relief requested: a finding of equivalent protection under 11 NCAC 08 .1504(b) and an order overruling the determination. See attached.

DocuSigned by:
 Signature _____
 27EA1DBF95F94DA...

DATE: 8/12/2026

APPEAL TO NCDOI/NCBCC

FORM 3/14/17

202.9 Appeals

202.9.1 Engineering Division. A written technical interpretation shall be provided as specified in Section 203.2.1.2. Any person may appeal in writing an order, decision, or determination pertaining to the code or any state building law by filing written notice with the Commissioner of Insurance or his designee within ten (10) days after the order, decision, or determination. A copy of the appeal shall be furnished to each party.
(General Statutes 143-140, 153A-374 and 160A-434)

203.2.1 Interpretations

203.2.1.1 Informal Interpretations. The Engineering Division shall provide informal interpretations on code related matters either by e-mail, letter or telephone. These informal interpretations may be accepted by the local code enforcement official or party requesting the interpretation. Either party may request a formal interpretation of the code.

203.2.1.2 Formal Interpretations. Any person may request in writing a formal interpretation of the code. The request shall be addressed to the Chief Code Consultant for the Department of Insurance. The request shall be specific and shall reference the code sections in question. All formal interpretations shall be in writing. A formal interpretation shall be binding on all parties unless appealed to the Building Code Council as specified in Section 201.9.2. Formal interpretations determined to be of a general nature may be posted on the Department website. (General Statute 143-140)

203.2.2 Appeals. Any person may appeal in writing an order, decision, or determination of a code enforcement official pertaining to the code or any state building law. The appeal shall be addressed to the Chief Engineer for the Department of Insurance by filing written notice within ten (10) days after the order, decision, or determination. The appeal shall contain the type and size of the building in question, the location of the building, and shall reference the code sections in question. The decision shall be in writing and shall set forth the facts found. The decision rendered shall be based on the technical provisions of the code, public health and safety and shall be construed liberally to those ends. A decision shall be binding on all parties unless appealed to the Building Code Council as specified in Section 201.9.2. A copy of the appeal and written decision shall be furnished to each party. (General Statutes 153A-374 and 160A-434)

202.9.2 Building Code Council. The Building Code Council shall hear appeals from the decisions of State enforcement agencies relating to any matter related to the code. Any person wishing to appeal a decision of a State enforcement agency to the Building Code Council shall give written notice of appeal as follows:

202.9.2.1 Twenty one (21) copies including an original of the Notice of Appeal shall be filed with the Building Code Council c/o NC Department of Insurance, Engineering Division, 325 North Salisbury Street, Room 5_44, Raleigh, NC 27603 and one (1) copy shall be filed with the State enforcement agency from which the appeal is taken.

202.9.2.2 The Notice of Appeal shall be received no later than thirty (30) days from the date of the decision of the State enforcement agency.

202.9.2.3 The Notice of Appeal shall be legibly printed, typewritten or copied and shall contain the following:

- (1) Name, address of the party or parties requesting the appeal.
- (2) The name of the State enforcement agency, the date of the decision from which the appeal is taken, and a copy of the written decision received from the enforcement agency.
- (3) The decision from which the appeal is taken shall be set forth in full in the Notice of Appeal or a copy of the decision shall be attached to all copies of the Notice of Appeal.
- (4) The contentions and allegations of fact must be set forth in full in a clear and concise manner with reference to the sections of the code in controversy.
- (5) The original Notice of Appeal shall be signed by the party or parties filing appeal.
- (6) The Notice of Appeal shall be received by the first day of the month prior to the Building Code Council's quarterly scheduled meeting in order to be placed on the agenda for that meeting. The Chairman may schedule a special meeting to hear an appeal.

202.9.2.4 Upon the proper filing of the Notice of Appeal, the Building Code Council Secretary shall forward one (1) copy of the Notice of Appeal to each member of the Building Code Council. The Chairman may appoint a Hearing Committee to hear appeals. The Secretary shall send notice in writing to the party or parties requesting an appeal and to the Building Code Council Hearing Committee members at least fifteen (15) days prior to the Hearing Committee meeting. A written decision of the Hearing Committee meeting shall be provided to all Building Code Council Members. The actions of the Hearing Committee shall be final, unless appealed to the full Building Code Council in writing within 30 days of the Hearing Committee's action. If a Hearing Committee consists of at least seven Council members, it will constitute a quorum of the full Council. Further appeals shall be as specified in Section 202.9.3.

202.9.2.5 The Building Code Council shall, upon a motion of the State enforcement agency or on its own motion, dismiss appeals for the following reasons:

- (1) Not pursued by the appellant or withdrawn;
- (2) Appeal not filed in accordance with these rules; or
- (3) Lack of jurisdiction.

202.9.2.6 When the Building Code Council finds that a State enforcement agency was in error in its interpretation of the code, the Building Code Council shall remand the case to the agency with instructions to take such actions as the Building Code Council directs. When the Building Code Council finds on appeal that materials or methods of construction proposed are equivalent to those required by the code, the Building Code Council shall remand the case to the State enforcement agency with instructions to permit the use of such materials or methods of construction. The Building Code Council shall immediately initiate procedures for amending the code to permit the use of such materials or methods of construction.

202.9.2.7 The Building Code Council shall provide a written decision setting forth the findings of fact and the Building Code Council's conclusions to each party or parties filing the appeal and to the State enforcement agency from which the appeal was taken.

202.9.3 Superior Court. Whenever any person desires to appeal a decision of the Building Code Council or a decision of a State or local enforcement agency, he may appeal either to the Wake County Superior Court or the Superior Court of the county in which the proposed building is to be situated in accordance with the provisions of Chapter 150B of the General Statutes.
(General Statute 143-141(d))

ATTACHMENT TO APPENDIX E APPEAL FORM

Supporting information attached pursuant to the instruction on the Appendix E form:

"Include all background information as required by the referenced General Statutes and the attached policies. Attach additional supporting information."

North Carolina Building Code Council | NC Department of Insurance, Engineering Division

Submitted in support of the Notice of Appeal filed July 9, 2026. This form and attachment supplement that filing and do not initiate a new appeal.

Marked on form:	Appeal of Local Decision to NCDOI
DATE	July 9, 2026
APPELLANT	Kyle E. Chandler
PHONE	(828) 545-9111
REPRESENTING	KC Construction Company LLC — NC General Contractor License #82407
ADDRESS	188 Toronto Trail
CITY / STATE / ZIP	Clyde, NC 28721
E-MAIL	builtbykc@gmail.com
CO-APPELLANT	Paden Brunault, Owner of Record — 153 Foxtail Trail, Asheville, NC 28806
CODE	2018 North Carolina Residential Code; North Carolina Administrative Code and Policies
SECTION(S)	R302.11.1 Item 7; R316.6 (2018 NCRC); Section 105 (NC Administrative Code and Policies); G.S. 143-140.1; 11 NCAC 08 .1501–.1505

REASON FOR APPEAL

BUILDING AND LOCATION

One-family residential dwelling; wood post-frame (Type V) construction; approximately 3,100 square feet; two stories. Permitted under the 2018 North Carolina Residential Code. Wall assembly: horizontal 2x6 wood girts, corrugated metal cladding, closed-cell spray polyurethane foam (Heatlok HFO Pro) applied to the interior at the insulation stage, with open-cell foam cavity fill. Permit BLD2025-01146, Buncombe County. Location: 153 Foxtail Trail, Asheville, North Carolina 28806. Owner of record: Paden Brunault. Contractor of record: KC Construction Company LLC, NC General Contractor License #82407.

DETERMINATION APPEALED

Written determination of Buncombe County Permits and Inspections dated July 2, 2026, captioned as a review of an alternative material, design, or method under Section 105 of the North Carolina Administrative Code and Policies, declining to approve the proposed wall assembly with respect to the fireblocking requirements of R302.11.

GROUND(S)

1. The determination cites ICC-ES ESR-4073 as its evaluation basis at Exhibit 2. ESR-4073 evaluates Heatlok HFO High Lift. The product proposed for this assembly is Heatlok HFO Pro, which is evaluated under IAPMO UES ER-565.
2. The determination quotes Section 1.0 of ER-565 without Section 3.0, which states that the product is used in Types I through V construction and in one- and two-family dwellings regulated under the International Residential Code.
3. Traditional wood fireblocking is installed at all interlevel separations required by R302.11 and is ready for inspection. The closed-cell foam is not proposed in place of that fireblocking. The only condition in dispute is the

void at the corrugation profile where the metal panel meets the framing.

4. The closed-cell application seals that void at the insulation stage, leaving no continuous concealed draft opening — the condition R302.11 states it exists to prevent. That material cannot be installed until the framing inspection passes. The Exhibit 4 photographs relied upon in the determination show the assembly at the framing stage, which is the only condition that can exist before the material is applied.

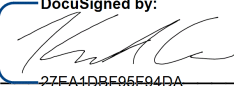
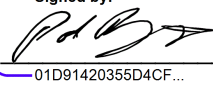
5. Heatlok HFO Pro is a tested air barrier material. Intertek Report L4520.01-801-44 R0 measured air leakage of the opaque wall assembly under ASTM E2357 at 0.0024 L/s·m². R302.11.1 accepts air-permeable unfaced fiberglass batts as fireblocking.

RELIEF REQUESTED

A finding under 11 NCAC 08 .1504(b) that the proposed assembly provides the equivalent level of protection of public health, safety, and welfare prescribed by the Code, and an order overruling the determination of July 2, 2026.

PRIOR FILINGS IN THIS MATTER

This appeal is timely. The determination issued July 2, 2026; the Notice of Appeal was filed July 9, 2026 — within the 30 days provided by 11 NCAC 08 .1501. An Appendix E form addressing the February 17, 2026 framing determination in this matter was filed with this office on March 5, 2026. This form addresses the July 2, 2026 written determination specifically. A Notice of Appeal was filed July 9, 2026 and acknowledged July 10, 2026. Supporting documentation is submitted with the accompanying correspondence.

DocuSigned by:		
Signature:		8/12/2026
	27EA1DBF06F04DA...	Date: _____
Kyle E. Chandler, Owner, KC Construction Company LLC		
Signed by:		
Signature:		8/12/2026
	01D91420355D4CF...	Date: _____
Paden Brunault, Owner of Record, 153 Foxtail Trail — Co-Appellant		

Attachment to Appendix E appeal form (FORM 3/14/17).

ATTACHMENT TO APPENDIX E APPEAL FORM

Supporting information attached pursuant to the instruction on the Appendix E form:

"Include all background information as required by the referenced General Statutes and the attached policies. Attach additional supporting information."

North Carolina Building Code Council | NC Department of Insurance, Engineering Division

Submitted in support of the Notice of Appeal filed July 9, 2026. This form and attachment supplement that filing and do not initiate a new appeal.

Marked on form:	Appeal of Local Decision to NCDOI
DATE	July 9, 2026
APPELLANT	Kyle E. Chandler
PHONE	(828) 545-9111
REPRESENTING	KC Construction Company LLC — NC General Contractor License #82407
ADDRESS	188 Toronto Trail
CITY / STATE / ZIP	Clyde, NC 28721
E-MAIL	builtbykc@gmail.com
CO-APPELLANT	Paden Brunault, Owner of Record — 153 Foxtail Trail, Asheville, NC 28806
CODE	2018 North Carolina Residential Code; North Carolina Administrative Code and Policies
SECTION(S)	R703.1.1 Exception 2 (2018 NCRC); Section 105 (NC Administrative Code and Policies); G.S. 143-140.1; 11 NCAC 08 .1501–.1505

REASON FOR APPEAL

BUILDING AND LOCATION

One-family residential dwelling; wood post-frame (Type V) construction; approximately 3,100 square feet; two stories. Permitted under the 2018 North Carolina Residential Code. Wall assembly: horizontal 2x6 wood girts, corrugated metal cladding, closed-cell spray polyurethane foam (Heatlok HFO Pro) applied to the interior at the insulation stage, with open-cell foam cavity fill. Permit BLD2025-01146, Buncombe County. Location: 153 Foxtail Trail, Asheville, North Carolina 28806. Owner of record: Paden Brunault. Contractor of record: KC Construction Company LLC, NC General Contractor License #82407.

DETERMINATION APPEALED

Written determination of Buncombe County Permits and Inspections dated June 29, 2026, captioned as a review of an alternative material, design, or method under Section 105 of the North Carolina Administrative Code and Policies, declining to accept the proposed water-resistive barrier assembly.

GROUND S

1. The determination cites ICC-ES ESR-4073 as its evaluation basis at Exhibit 2. ESR-4073 evaluates Heatlok HFO High Lift. The product proposed for this assembly is Heatlok HFO Pro, which is evaluated under IAPMO UES ER-565.
2. The determination states that ASTM E331, ASTM E330, and ASTM D226 approvals are not listed for the product. Intertek Report L4520.01-801-44 R0 reports ASTM E331 testing of the product at 15 psf for 120 minutes with no water penetration.
3. The determination quotes Section 1.0 of ER-565 without Section 3.0, which states that the product is used in Types I through V construction and in one- and two-family dwellings regulated under the International Residential Code.

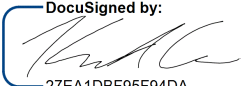
4. 2018 NCRC R703.1.1 Exception 2 permits a water-resistive barrier demonstrated by testing in lieu of a prescriptive product. The Intertek report referenced above is that demonstration. The county inspector confirmed this pathway in writing on February 17, 2026.

RELIEF REQUESTED

A finding under 11 NCAC 08 .1504(b) that the proposed water-resistive barrier assembly provides the equivalent level of protection of public health, safety, and welfare prescribed by the Code, and an order overruling the determination of June 29, 2026.

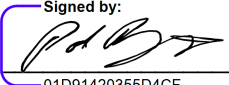
PRIOR FILINGS IN THIS MATTER

This appeal is timely. The determination issued June 29, 2026; the Notice of Appeal was filed July 9, 2026 — within the 30 days provided by 11 NCAC 08 .1501. An Appendix E form addressing the February 17, 2026 framing determination in this matter was filed with this office on February 27, 2026. This form addresses the June 29, 2026 written determination specifically. A Notice of Appeal was filed July 9, 2026 and acknowledged July 10, 2026. Supporting documentation is submitted with the accompanying correspondence.

Signature:  27EA4DBF95F94DA...

8/12/2026
Date: _____

Kyle E. Chandler, Owner, KC Construction Company LLC

Signature:  01D91420355D4CF...

8/12/2026
Date: _____

Paden Brunault, Owner of Record, 153 Foxtail Trail — Co-Appellant

Attachment to Appendix E appeal form (FORM 3/14/17).

KC Construction Company LLC

Kyle Chandler, Owner — NC General Contractor License #82407

188 Toronto Trail, Clyde, NC 28721

(828) 545-9111 | builtbykc@gmail.com

July 8, 2026

Chief Engineer

Engineering Division, Office of State Fire Marshal

North Carolina Department of Insurance

1202 Mail Service Center

Raleigh, NC 27699-1202

RE: NOTICE OF APPEAL UNDER SECTION 203.2.2, 2018 NC ADMINISTRATIVE CODE AND POLICIES**Appeal of Two Written Determinations of the Buncombe County Code Enforcement Official**

Permit BLD2025-01146 — 153 Foxtail Trail, Asheville, NC 28806

Dear Chief Engineer:

Pursuant to Section 203.2.2 of the 2018 North Carolina State Building Code: Administrative Code and Policies, I hereby file written notice of appeal of the following two orders/determinations issued by Jason R. Rogers, Director, Buncombe County Permits and Inspections:

1. Written determination dated June 29, 2026, denying the alternative material, design or method under Section 105 of the NC Administrative Code for compliance with the water-resistive barrier requirements of 2018 NC Residential Code Section 703 (R703.1.1, Exception 2).
2. Written determination dated July 2, 2026, denying the alternative material, design or method under Section 105 of the NC Administrative Code for compliance with the fireblocking requirements of 2018 NC Residential Code Section R302.11.

This notice is filed within 10 days of each determination.

TYPE AND SIZE OF BUILDING

One-family residential dwelling; wood post-frame (Type V) construction; approximately 3,100 square feet; Two stories. Permitted under the 2018 NC Residential Code, Permit BLD2025-01146, Buncombe County.

LOCATION OF BUILDING

153 Foxtail Trail, Asheville, NC 28806 (Buncombe County). Owners: Gary and Paige Brunault.

CODE SECTIONS IN QUESTION

2018 NC Residential Code Sections R703 and R703.1.1, Exception 2 (water-resistive barrier — ASTM E331 performance path); R302.11 and R302.11.1 (fireblocking); R316.6 (foam plastic); and R104.11 / R104.11.1 (alternative materials, design and methods; research and evaluation reports from approved, accredited sources). 2018 NC Administrative Code Section 105 (alternate material, design or methods).

BASIS OF APPEAL (SUMMARY)

The wall assembly employs Heatlok HFO Pro closed-cell spray polyurethane foam (IAPMO UES ER-565) as the water-resistive barrier under the performance path of R703.1.1, Exception 2. The product is substantiated by Intertek Test Report No. L4520.01-801-44 R0 (ASTM E331: 15 psf differential pressure, 120 minutes, no water penetration; ISO/IEC 17025-accredited laboratory). The June 29 determination states that ASTM E331 substantiation is “not listed for this product”; the accredited E331 test report exists and is enclosed, and it does not appear among the determination’s listed exhibits. The June 29 determination further relies on ICC-ES ESR-4073, whose evaluation subject is a different product (Heatlok HFO High Lift). Both determinations quote ER-565 Section 1.0 (recognition scope, Types I–IV) without addressing Section 3.0 (Product Use), which states the product “is used in Types I, II, III, IV, and V construction under the IBC and in one- and two-family dwellings under the IRC.” The subject building is a one-family dwelling under the IRC/NCRC. Appellant contends both determinations rest on evidence not applicable to the installed product and do not address the accredited test data and evaluation-report language directly on point, contrary to R104.11 and R104.11.1.

The project has been under a continuous work stoppage since February 16, 2026 — more than 140 days. A prompt written decision is respectfully requested.

A copy of this notice is being furnished to the Buncombe County Permits and Inspections Department per Section 203.2.2.

ENCLOSURES

3. Buncombe County written determination, June 29, 2026 (Section 703 / WRB)
4. Buncombe County written determination, July 2, 2026 (Section 302.11 / fireblocking)
5. IAPMO UES Evaluation Report ER-565 (Heatlok HFO Pro)
6. Intertek Test Report No. L4520.01-801-44 R0 (ASTM E331)
7. Huntsman Building Solutions engineering letters (March 2, 2026 — WRB; March 3, 2026 — fireblocking)

Respectfully submitted,

Kyle Chandler

Owner, KC Construction Company LLC

NC General Contractor License #82407

A handwritten signature in black ink, appearing to read 'K. Chandler', written in a cursive style.

Mr. Love — per our meeting on July 16, these are the questions submitted for written response.

Mr. Rogers,

On July 16, 2026, I met with Mr. Love regarding the June 29 and July 2, 2026 determinations for 153 Foxtail Trail. In that meeting it was agreed that the questions raised by these determinations deserve written answers. That agreement exists because of a pattern: this project has been failed repeatedly without reasons given. The March 20 response to two project-specific engineering letters cited no code section and stated no reason. The July 10 response to a three-point written rebuttal — delivered with the ASTM E331 test report — did not address a single one of the three points. Determinations have been issued; engagement has not. This letter submits those questions. Each is tied to a specific statement in the written record, and each admits of a direct answer. I ask for written answers to each numbered question by close of business Tuesday, July 21, 2026. That timeline reflects that every question below concerns statements in the county's own determinations and evidence that has been before the county since July 8 or earlier — and that this project has now been stopped for 151 days. This correspondence and any responses will be furnished to the NC Department of Insurance, Engineering Division, as part of the record in the pending appeal filed July 9, 2026 under Section 203.2.2.

A. Authenticity of the submitted documentation

Mr. Love relayed a concern that the submitted documentation — the IAPMO UES evaluation report, the Intertek test report, and the Huntsman engineering letters — is not authentic because it is not sealed by a professional engineer.

That concern rests on a misunderstanding of how the code authenticates this class of document. Laboratory test reports and evaluation reports are not sealed by professional engineers; they are authenticated by the accreditation of the body that issues them. Section 105 of the NC Administrative Code and Policies — the same section under which both determinations were issued — provides for approval of alternates by the code enforcement official and authorizes tests as evidence of compliance. Neither determination cites any code section requiring a professional engineer's seal on a laboratory test report or an evaluation report — because the code's mechanism for authenticating such evidence is the accreditation of the issuing body, not an engineer's seal.

The accreditation status of each document's source is a matter of public record:

- IAPMO Uniform Evaluation Service (ER-565) is accredited by the ANSI National Accreditation Board (ANAB) under ISO/IEC 17065, General Requirements for Bodies Operating Product Certification Systems. ER-565 is published on IAPMO UES's public directory at uniform-es.org, where the county can retrieve it directly. ER-565 Section 6.10 further confirms the product's test reports come from laboratories complying with ISO/IEC 17025.
- Intertek Testing Services NA (Report No. L4520.01-801-44 R0) holds ISO/IEC 17025 accreditation for building-product testing, including the water-penetration and air-barrier test methods at issue. Intertek will verify the authenticity of its own report number directly to the county upon request.
- Huntsman Building Solutions' engineering letters are signed by Paul Warren, Huntsman's Building Science and Engineering Manager, on Huntsman letterhead, and are verifiable with Huntsman directly.

We invite the county to verify all three. A party submitting fabricated documents does not invite the receiving agency to verify them with the issuing bodies.

QUESTION 1: Does the county dispute the authenticity of ER-565, Intertek Report L4520.01-801-44 R0, or the Huntsman engineering letters? If so, state the specific basis, and identify the code section that requires a professional engineer's seal on an accredited laboratory's test report or an accredited evaluation body's report.

B. Documented errors in the June 29 and July 2 determinations

Wrong product cited. Both determinations list ICC-ES Evaluation Report ESR-4073 as Exhibit 2 and draw conclusions from it. ESR-4073's evaluation subject is Heatlok HFO High Lift. The product installed and under review at 153 Foxtail Trail is Heatlok HFO Pro, covered by IAPMO UES ER-565 — your own Exhibit 1. These are two different Huntsman products with two different evaluation reports.

QUESTION 2: Do you agree that ESR-4073 and ER-565 cover two different products? Which conclusions in the June 29 and July 2 determinations rest on Exhibit 2, and will those conclusions be withdrawn? If the county's position is that its conclusions do not rest on Exhibit 2, explain why a different product's evaluation report was cited in both determinations at all.

The E331 statement. The June 29 determination states, under Exhibit 3: "The NC Residential code section 703 has three ASTM approval sections ASTM E331, ASTM E330 and ASTM D226. These approvals are not listed for this product." Intertek Report L4520.01-801-44 R0 is an ASTM E331 test of Heatlok HFO Pro — 15 psf differential pressure, 120 minutes, no water penetration — delivered to your office on July 8, 2026 and absent from the determination's exhibit list.

QUESTION 3: Is the statement that ASTM E331 "approvals are not listed for this product" accurate as written — yes or no? If the county's position has changed now that the report is in hand, state the new position in writing.

Half the evaluation report quoted. Both determinations quote ER-565 Section 1.0 and stop at "exterior walls of Types I-IV construction." Section 3.0 (Product Use) of the same report, on the same page, states: "Heatlok HFO Pro insulation is used in Types I, II, III, IV, and V construction under the IBC and in one- and two-family dwellings under the IRC." The building at 153 Foxtail Trail is a one-family dwelling permitted under the 2018 NC Residential Code — the exact use Section 3.0 names.

QUESTION 4: Was Section 3.0 reviewed before the determinations were issued? On what basis does Section 1.0 control over Section 3.0 for a one-family dwelling under the IRC?

C. The written record

Your own inspector conceded the pathway. On February 17, 2026, Inspector Keynan Phillips wrote (cc to you): "You also state that 703.1.1 exception 2 allows the deletion of the prescriptive water barrier through compliance with ASTM 331 which is correct." The only objection raised that day was whether the testing existed. It does, and it has now been delivered.

QUESTION 5: Does the county still agree that the R703.1.1 Exception 2 pathway is correct, as Inspector Phillips stated in writing on February 17? If yes, the dispute is about evidence only — state specifically what evidence remains missing. If the county's position has changed since February 17, state what changed, when, and on what code basis.

The March 20 response. On March 18, 2026, two project-specific engineering letters from the manufacturer were delivered with one question: whether the engineering data was sufficient to clear the framing holds. The county's complete response on March 20 was: "We have reviewed the

documents. This will not change our interpretation for these products." No code section was cited. No reason was given.

QUESTION 6: What was the specific code basis for rejecting the two Huntsman engineering letters on March 20, 2026? If no code section supported the rejection at the time it was issued, confirm that in writing.

The alternatives contradiction. The July 2 determination states that Section 302.11 "has specific materials listed. There is not any standards listed to create an alternative material." Yet the determination is itself titled a review of Alternative Material, Design or Method under Section 105 of the NC Administrative Code — and Section 105.1 states the codes "are intended to allow the use of any alternate material, design or method of construction," and that an alternative shall be approved where the code enforcement official finds it complies with the intent and provisions of the code. The absence of a material from a prescriptive list is the reason the alternative-materials pathway exists; it is not grounds for refusing to evaluate an alternative.

QUESTION 7: Is it the county's position that no alternative to the materials listed in Section 302.11 can ever be approved under Section 105? If not, state the specific criteria the county applied in evaluating this alternative, and where those criteria appear in the July 2 determination.

The Exhibit 4 photographs show an incomplete assembly. Both determinations rely on Exhibit 4 site photographs — the July 2 letter cites them as showing "areas not sealed." Those photographs show the assembly before the insulation stage. In the proposed assembly, closed-cell foam is applied against the corrugated panel at the insulation stage. The foam conforms to the corrugation profile and seals the flute channels at every framing line, plate line, and floor/ceiling intersection. Any residual space behind a framing member becomes an isolated, fully enclosed pocket — sealed above and below by foam, bounded by wood on one face and metal on the other — with no vertical continuity and no air supply.

That is exactly the condition Section R302.11 requires. Its stated purpose is "to cut off both vertical and horizontal concealed draft openings." Fireblocking compartmentalizes concealed spaces; it has never required eliminating cavities. A wall fireblocked with the code's own listed materials still contains air-filled cavities between the blocks — what the code prohibits is a continuous concealed draft path, and after application none remains. The Intertek report already in the record measured the air leakage of this foam assembly under ASTM E2357 at 0.0024 L/s·m² at 75 Pa — essentially airtight. By comparison, Section R302.11.1 lists batts or blankets of mineral wool or glass fiber — air-permeable materials — as acceptable fireblocking. A sealed, air-impermeable compartment cannot fail a standard that air-permeable batts satisfy.

The code-listed fireblocking is already installed. All fireblocking separating the levels of this dwelling — the interlevel cut-offs Section R302.11 requires between stories and between the top story and roof space — is installed, in materials listed in Section R302.11.1, and is ready for inspection today. The only condition in dispute is the corrugation flute at the wall cavity, which is precisely what the closed-cell application seals. The framing hold imposed February 16 is itself what prevents the application of the material the photographs are cited as showing missing.

QUESTION 8: Do the Exhibit 4 photographs depict the completed proposed assembly, or the assembly prior to foam application? If the latter, on what basis does the condition of a not-yet-completed assembly establish that the completed assembly fails to perform? The county is invited to verify the completed condition directly: at the insulation inspection, county staff may select any location in the structure, witness the application, and direct a test cut at any point of their choosing to confirm the

flute channels are sealed and no continuous concealed draft opening remains. Will the county accept this witnessed field verification?

D. Corrections to the record

The addressee. Both determinations are addressed to "Kevin Evan Chandler." The licensed contractor of record on Permit BLD2025-01146 is Kyle Evan Chandler, KC Construction Company LLC, NC GC License #82407.

QUESTION 9: Please correct the addressee on both determinations and confirm the correction in writing.

The county retains the authority to resolve this

In our July 16 meeting, the county's position was that this matter should now be resolved at the state level. To be clear about what the code actually provides: Section 105.1 of the NC Administrative Code and Policies states that the code is intended to allow the use of any alternate material, design or method of construction, places the approval authority with the *code enforcement official*, and directs that an alternative **shall be approved** where the official finds it complies with the intent and provisions of the code. The pending appeal does not remove the county's authority to amend its own determinations — that authority remains on your desk today. Referring this to the State is a choice, not a requirement.

And the cost of that choice is not evenly shared. This project has been stopped since February 16, 2026 — 151 days. Every day of non-decision is carried entirely by the homeowners and by my company. It costs the county nothing to leave this unresolved. That asymmetry is why I am asking the county to act on the evidence in front of it rather than wait to be overruled.

QUESTION 10: Is there anything in the code or in county policy that prevents the county from amending the June 29 and July 2 determinations today, based on the accredited test report and evaluation report now in the record? If yes, cite it. If the county nonetheless elects to await the State's ruling rather than amend, confirm in writing that the county stands by both determinations as written — including the Exhibit 2 citation to ESR-4073 and the statement that ASTM E331 approvals "are not listed for this product" — as the record the county submits for the State's review.

The standard that will govern

For clarity on where this dispute is headed: under 11 NCAC 08 .1504(b), if the Department of Insurance Engineering Division determines that the alternative design and construction provides the equivalent level of protection of public health, safety, and welfare prescribed by the Code, the Engineering Division **shall overrule** the determination by the local authority. The question before the State is equivalency — demonstrated here by an accredited laboratory's passing ASTM E331 test and an ANAB-accredited evaluation report naming this exact building type. The questions above give the county the opportunity to address the record before the State rules on it. And that ruling is imminent: under Section 203 of the NC Administrative Code and G.S. 143-140.1, the Engineering Division's decision on a Section 105.3 alternate-materials appeal is due within 10 business days.

I ask for written answers to each numbered question by close of business Tuesday, July 21, 2026. Each numbered question admits of a direct answer. A response that does not directly answer a numbered question will be recorded in the appeal as a question the county was unable to answer. Silence will be recorded the same way. I remain available to meet on site with you and Mr. Love at any time.

Respectfully,

Kyle Chandler
KC Construction Company LLC
NC General Contractor License #82407
188 Toronto Trail, Clyde, NC 28721
(828) 545-9111 | builtbykc@gmail.com



Permits & Inspections

Jason Rogers
Director

July 2, 2026

Kevin Evan Chandler
188 Toronto Trail
Clyde, NC 28721

Re: Review of Alternative Material, Design or Method in accordance with section 105 of the NC Administrative Code for 153 Foxtail Trail for compliance with the Fire Blocking requirements of 2018 NC Residential Building Code section 302.11.

Dear Mr. Chandler:

On June 23, 2026, your team met with Jason Rogers, Director, Permits and Inspections and Tim Love, Assistant County Manager. In this meeting it was agreed that the Inspection Department Team would evaluate this alternative method again as requested for compliance.

After review, we have confirmed that the building does not have completed fire blocking prescriptively in accordance with section 302.11 of the North Carolina Residential Building Code.

- We have reviewed your supporting evidence, Heatlok® HFO PRO Spray-Applied Polyurethane Foam Plastic Insulation. IAMPO Uniform Evaluations Services ("UES") Evaluation Report Number 565 (exhibit 1), 1.0 Recognition states: "The physical properties, water vapor resistance, air permeance, thermal resistance, and attic and crawl space installations, and exterior walls of Types I-IV construction were evaluated to comply with the intent of the following codes and regulations". The 2015 Residential Code is listed. This is the base code for the 2018 NC Residential Building Code.
- We have also sourced ICC-ES Evaluation Report ESR-4073 (exhibit 2)- This evaluation states" Heatlok HFO closed cell spray foam is a spray-applied polyurethane foam plastic insulation used as a nonstructural thermal insulating material in all types of construction under the IBC and in dwellings under the IRC".
- We have also reviewed the Technical Data Sheet for Heatlok HFO PRO (exhibit 3) for reference standard evaluations.
- We have also provided photographs of the situation as they exist on site (exhibit 4).

The Heatlok HFO is not supported in the documentation for specific use on this project for fire blocking material.

- Exhibit 1- does not provide evidence that this product is equivalent to any of the building material in section 302.11.1
- Exhibit 2- Has no supporting evidence that this product can be used as fire blocking material or is an alternative material of such.
- Exhibit 3- The NC Residential code section 302.11 has specific materials listed. There is not any standards listed to create an alternative material.
- Exhibit 5- Letter supplied by Mr. Paul Warren from Huntsman Building Solutions

Further, the spray foam application is not an alternative to the requirements of section 302.11. The vertical spaces are required to be fire blocked to effectively seal concealed draft openings. See exhibit 4 for photographs of areas not sealed.

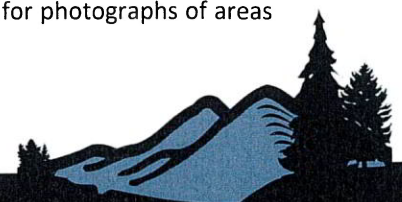


Exhibit 5 was submitted by Mr. Paul Warren stating that this product eliminates this code section. This was discussed with the Department of Insurance Engineering Division, and this product does not eliminate this requirement. Multiple attempts have been made to contact Mr. Warren and we have had no further responses.

In conclusion, Heatlok® is not acceptable alternative material, design or method. Heatlok is not an equivalent material to those listed in section 302.11.2 of the N2018 NC Residential Building Code

This was also discussed with the Chief Code Consultant with the NC Department of Insurance. During this conversation it was pointed out that the concealed locations in combustible construction are required to be installed and that the foam insulation was not an approved material.

This decision can be appealed to the NC Department of Insurance in accordance with section 203.2.2 of the 2018 NC Administrative Code and Policies.

203.2.2 Appeals

Any person may appeal in writing an order or determination of a code enforcement official pertaining to the code or any state building law. The appeal shall be addressed to the Chief Engineer of the Department of Insurance by filing written notice within 10 days after the order, decision or determination. The appeal shall contain the types and size of the building in question, the location of the building and shall reference the code section(s) in question. The decision shall be in writing and shall set forth the facts found. The decision rendered shall be based on the technical provisions of the code, public health and safety and shall be construed liberally to those ends. A decision shall be binding on all parties unless an appeal is submitted to the Building Code Council as specified in section 201.9.2. A copy of the appeal and written decision shall be furnished to both parties.

Sincerely,

Jason R. Rogers
Director, Permits and Inspections
35 Woodfin Street, Asheville, NC 28801
828-250-5384
jason.rogers@buncombenc.gov



EVALUATION REPORT

Number: 565

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Valid Through: 03/31/2026

HUNTSMAN BUILDING SOLUTIONS, INC.
3315 East Division Street
Arlington, Texas 76011
Phone: (817) 640-4900
www.huntsmanbuilds.com

HEATLOK® HFO PRO SPRAY-APPLIED POLYURETHANE FOAM PLASTIC INSULATION

CSI Section:

07 21 00 Thermal Insulation

1.0 RECOGNITION

Heatlok® HFO Pro spray-applied polyurethane foam plastic insulation has been evaluated for use as spray foam insulation complying with IBC Section 2603; IRC Section R316; and 2021, 2018, 2015, and 2012 IECC Sections C303, C402, R303, and R402; and 2009 IECC Sections 303, 402, and 502. The physical properties, water vapor resistance, air permeance, thermal resistance, surface burning characteristics, fire-resistance, and attic and crawl space installations, and exterior walls of Types I-IV construction were evaluated to comply with the intent of the following codes and regulations:

- 2021, 2018, 2015, 2012, and 2009 International Building Code® (IBC)
- 2021, 2018, 2015, 2012, and 2009 International Residential Code® (IRC)
- 2021, 2018, 2015, 2012, and 2009 International Energy Conservation Code® (IECC)

2.0 LIMITATIONS

Use of the Heatlok® HFO Pro spray-applied polyurethane foam plastic insulation recognized in this report is subject to the following limitations:

2.1 The insulation and coating products shall be installed in accordance with the manufacturer's published installation instructions, this evaluation report, and the applicable code. If there are any conflicts between the manufacturer's published installation instructions and this report, the more restrictive shall govern.

2.2 Except as permitted by the applicable building code, the insulation shall be separated from the interior of the building by a code-complying thermal barrier or shall be installed as an alternative thermal barrier assembly in accordance with Section 4.5.1 of this report

2.3 The insulation shall not exceed the nominal density and thickness for the installation conditions described in this report.

2.4 During application, the insulation shall be protected from exposure to weather.

2.5 The insulation shall be installed by professional spray polyurethane foam installers authorized by Huntsman Building Solutions, Inc.

2.6 Use of the insulation in areas of "very heavy" termite infestation probability shall be in accordance with 2021, 2018, 2015, and 2009 IBC Section 2603.8, and 2012 IBC Section 2603.9, or IRC Section R318.4, as applicable.

2.7 Heatlok® HFO PRO insulation qualifies as a vapor retarder when installed as required in Section 4.7 of this report.

2.8 Labeling and jobsite certification of the insulations and coatings shall comply with the following code sections as applicable:

- 2021, 2018, 2015, or 2012 IBC Section 2603.2
- 2021, 2018, 2015, or 2012 IRC Section R316.2
- 2021, 2018, and 2015 IRC Section N1101.10.1.1
- 2012 IRC Section N1101.12.1.1
- 2009 IRC Section N1101.4
- 2021, 2018, 2015, or 2012 IECC Sections C303.1.1.1 or R303.1.1.1
- 2009 IECC Section 303.1.1.1

2.9 The insulation shall be produced by Huntsman Building Solutions, Inc. in Arlington, TX.

3.0 PRODUCT USE

Heatlok® HFO Pro spray-applied polyurethane foam plastic insulation complies with IBC Section 2603; IRC Section R316; and 2021, 2018, 2015, and 2012 IECC Sections C303, C402, R303, and R402; and 2009 IECC Sections 303, 402, and 502. When installed in accordance with Section 4.0 of this report, the foam plastic insulation is for use in wall cavities, floor assemblies or ceiling assemblies, exterior side of vertical foundations, or the underside of slabs. It may be used in attics and crawl spaces when installed with Section 4.5.1. Heatlok® HFO Pro insulation is used in Types I, II, III, IV, and V construction under the IBC and in one- and two-family dwellings under the IRC.

4.0 PRODUCT DESCRIPTION

4.1 Properties: Heatlok® HFO Pro is a medium density, closed cell, spray-applied polyurethane foam plastic insulation in accordance with Table 1 of AC377. The insulation has a nominal in-place density of 2.0 lb/ft³ (32 kg/m³). The two-component spray foam plastic is produced in the field by combining a polymeric isocyanate

The product described in this Uniform Evaluation Service (UES) Report has been evaluated as an alternative material, design or method of construction in order to satisfy and comply with the intent of the provision of the code, as noted in this report, and for at least equivalence to that prescribed in the code in quality, strength, effectiveness, fire resistance, durability and safety, as applicable, in accordance with IBC Section 104.11. This document shall only be reproduced in its entirety.

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(A component) and the Heatlok® HFO Pro resin (B component). The liquid components shall be stored in 55-gallon (208 L) drums at temperatures between 50°F and 100°F (10°C and 38°C) for the polymeric isocyanate and 59°F and 77°F (15°C and 25°C) for the Heatlok® HFO Pro resin. When Component A and Component B are stored in factory-sealed containers at the recommended temperatures, the maximum shelf life is twelve months for the polymeric isocyanate and six months for the Heatlok® HFO Pro resin.

4.2 Thermal Resistance (R-Values): Heatlok® HFO Pro spray-applied polyurethane foam plastic insulation has a thermal resistance (R-Value) at a mean temperature of 75°F (24°C) as shown in Table 1 of this report.

TABLE 1 Thermal Resistance (R-Values) ¹	
Thickness (inch)	Heatlok® HFO Pro R-Value (°F·ft ² ·h/Btu)
1	7.4
1.5	11
2	14
3	20
3.5	23
4	26
5	33
5.5	36
6	40
7	46
7.5	49
8	53
9	59
10	66
11	72
11.5	76
12	79

For SI: 1 inch = 25.4 mm, 1°F ft²·h/Btu = 0.176 110 K·m²/W.

¹R-Values are calculated based on tested K values at 1-inch and 4-inch thicknesses.

4.3 Surface Burning Characteristics: At a maximum thickness of 4 inches (102 mm) and a nominal density of 2.0 lb/ft³ (32 kg/m³), the Heatlok® HFO Pro insulation has a flame spread index of 25 or less and smoke-developed index of 450 or less when tested in accordance with ASTM E84. Greater thicknesses, depending on the end use, are recognized when installed in accordance with this report.

4.4 Fire-Protective Coatings and Coverings: Fire protective coatings, for use as alternative thermal barrier assemblies, shall be in accordance with Table 2 of this report, as applicable, and installed in accordance with Section 4.5 of this report.

4.5 Installations: Heatlok® HFO Pro spray-applied polyurethane foam plastic insulation shall comply with one of the following requirements:

- 2021, 2018, 2015, and 2012 IECC Section C402.1
- 2021, 2018, 2015, and 2012 IECC Section R402.1
- 2009 IECC Sections 402.1 or 502.1, as applicable

The manufacturer's published installation instructions for Heatlok® HFO Pro insulation and this report shall be available on the jobsite during installation. Where conflicts occur, the most restrictive governs.

Heatlok® HFO Pro insulation shall be spray-applied on the jobsite using equipment specified in the manufacturer's published installation instructions. The maximum in-service temperature for all areas shall not exceed the maximum temperature stated in the manufacturer's published installation instructions. The insulation shall be sprayed onto a clean, dry substrate that has been prepared in accordance with the manufacturer's installation instructions. The insulation shall not be used in electrical outlets or junction boxes or where the insulation will be in direct, continuous contact with water.

4.5.1 Thermal Barrier

4.5.1.1 Application with an Approved Thermal Barrier:

Except as provided for in Section 4.5.1.2 of this report, Heatlok® HFO Pro spray-applied polyurethane foam plastic insulation shall be separated from the interior by a thermal barrier in accordance with IBC Section 2603.4 or IRC Section R316, as applicable. When the insulation is separated from the interior by a prescriptive thermal barrier in accordance with IBC Section 2603.4 or IRC Section R316, the insulation thickness shall not be limited.

4.5.1.2 Alternative Thermal Barrier Assemblies: Heatlok®

HFO Pro spray-applied polyurethane foam plastic insulation may be installed without a thermal barrier as defined in Section 4.5.1.1 of this report when installed in accordance with Table 2 of this report and as referenced in JAPMO UES ER-499 or additional report by an approved evaluation entity to the requirements of AC456.

4.5.2 Installation in Attics or Crawl Spaces: Heatlok® HFO Pro spray-applied polyurethane foam plastic insulation may be installed in attics or crawl spaces when installed in accordance with this section (Section 4.5).

When installed in attics or crawl spaces where entry is made only for the service of utilities, Heatlok® HFO Pro insulation may be installed in accordance with this section. Heatlok® HFO Pro insulation need not be surfaced with a thermal barrier, however, such attic and crawl space areas shall be separated from the interior of the building by a thermal barrier in accordance with Section 4.5.2 of this report.

4.5.2.1 Installation Using a Prescriptive Ignition Barrier:

When installed within attics or crawl spaces where entry is made only for the service of utilities, Heatlok® HFO Pro spray-applied polyurethane foam plastic insulation, at a maximum thickness of 7.5 inches (191 mm) on walls and



other vertical surfaces and 11.5 inches (292 mm) on ceilings and other overhead surfaces, shall be covered with a prescriptive ignition barrier in accordance with IBC Section 2603.4.1.6 or IRC Sections R316.5.3 and R316.5.4, as applicable.

Exception: The prescriptive ignition barrier may be omitted when installed in accordance with Section 4.5.2.2 of this report.

4.5.2.2 Installation Using an Alternative Ignition Barrier Assembly: Heatlok® HFO Pro spray-applied polyurethane foam plastic insulation may be installed in attics and crawl spaces using an alternative ignition barrier assembly provided:

- Entry is only to service utilities in the attic or crawl space and no storage is permitted.
- Attic or crawl space areas cannot be interconnected.
- Air from the attic or crawl space cannot be circulated to other parts of the building.
- Attic ventilation is provided as required by 2021 and 2018 IBC Section 1202.2, 2015 and 2012 IBC Section 1203.2, or IRC Section R806 except where air-impermeable insulation is permitted in unvented attics and shall comply with the following code sections as applicable:

For Unvented Attics:

- 2021 and 2018 IBC Section 1202.3
- 2015 IBC Section 1203.3
- 2021, 2018, 2015, 2012, and 2009 IRC Section R806.5

Crawl space ventilation is provided as required by the following code sections as applicable:

- 2021 and 2018 IBC Section 1202.4
- 2015 IBC Section 1203.4
- 2012 and 2009 IBC Section 1203.3
- 2018, 2015, 2012, and 2009 IRC Section R408.1

- The foam plastic insulation is limited to the maximum thickness and density tested as shown in Section 4.5.2.2.1 of this report.
- In accordance with IMC (International Mechanical Code®) Section 701, combustion air is provided.

4.5.2.2.1 Alternative Ignition Barrier Assembly: Heatlok® HFO Pro spray-applied polyurethane foam plastic insulation may be installed without a prescriptive ignition barrier on walls, floors, ceilings, and other vertical and horizontal surfaces as defined in Section 4.5.2.1 of this report when limited to a maximum thickness of 7.5 inches (191 mm) on walls and other vertical surfaces and 11.5 inches (292 mm) on ceilings and other overhead surfaces.

4.6 Air Permeability: When tested in accordance with ASTM E2178 at a minimum thickness of 1 inch (25.4 mm), Heatlok® HFO Pro spray foam insulation is classified as air-

impermeable insulation in accordance with Section 1202.3 of the 2021 and 2018 IBC, Section 1203.3 of the 2015 IBC, and Section R806.5 of the 2021, 2018, 2015, and 2012 IRC or Section R806.4 of the 2009 IRC, as applicable.

4.7 Vapor Permeance: Heatlok® HFO Pro spray-applied polyurethane foam plastic insulation, when tested in accordance with the ASTM E96 desiccant method (Procedure A), has a permeance of less than 1.0 perms (57.4×10^{-9} g/Pa·s·m), at a minimum thickness of 1 inch (25 mm) and qualifies as a Class II vapor retarder in accordance with IBC Section 202 and IRC Section R202.

4.8 One-hour Fire-resistance Rated Assembly: The following load-bearing assembly based on testing to ASTM E119 provides a one-hour fire-resistance rating.

Framing: 3⁵/₈-inch (92 mm) 20-gauge steel studs with a maximum height of 10 feet (3 m) spaced at 16 inches (406 mm) on center inserted in a 20-gauge top and bottom steel track with lateral bracing at mid-wall height.

Exterior Surface: Two layers of 5/₈-inch-thick (15.9 mm) glass mat gypsum substrate complying with ASTM C1177. The base layer is installed with the long edge parallel to the studs with #6 by 1¹/₂-inch-long (38 mm) drywall screws spaced at 8 inches (203 mm) on center around the perimeter and 12 inches (305 mm) on center in the field. The face layer is installed with the long edge parallel to the studs with the base layer and face layer joints staggered by one stud space. The face wall is secured with #6 by 1⁷/₈-inch-long (48 mm) drywall screws spaced at 8 inches (203 mm) on center around the perimeter and 12 inches (305 mm) on center in the field.

Insulation: 3⁵/₈-inch-thick (92 mm) layer of Heatlok® HFO Pro spray-applied polyurethane foam plastic insulation applied in the cavities to the exterior gypsum completely filling the stud cavities.

Interior Cladding: Two layers of 5/₈-inch-thick (15.9 mm) Type X gypsum board complying with ASTM C1396. The base layer shall be installed with the long edge parallel to the studs with #6 by 1¹/₂-inch-long (38 mm) drywall screws spaced at 8 inches (203 mm) on center around the perimeter and 12 inches (305 mm) on center in the field. The face layer shall be installed with the long edge parallel to the studs with the base layer and face layer joints staggered by one stud space. The face wall is secured with #6 by 1⁷/₈-inch-long (48 mm) drywall screws spaced at 8 inches (203 mm) on center around the perimeter and 12 inches (305 mm) on center in the field.

4.9 Exterior Walls of Buildings of Type I, II, III, or IV Construction: When Heatlok® HFO Pro spray-applied polyurethane foam plastic insulation is used in exterior walls of buildings of Type I, II, III, or IV construction of any height, the insulation shall comply with IBC Section 2603.5 and this section. Heatlok HFO Pro insulation shall be installed at a maximum thickness of 3⁵/₈ inches (92 mm).



EVALUATION REPORT

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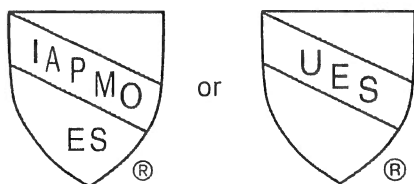
4.9.1 Complying Exterior Wall Assemblies: Wall assemblies that comply with Section 2603.5.5 of the IBC and this report that may be used in exterior walls of buildings of Type I, II, III, or IV construction of any height are described in Tables 3 and 4 of this report.

5.0 IDENTIFICATION

The spray foam insulation is identified with the following:

- Manufacturer's name (Huntsman Building Solutions), Inc.
- manufacturer's address and telephone number,
- the product trade name (Heatlok® HFO Pro)
- use instructions
- density, flame-spread and smoke-development indices
- date of manufacture or batch/run number
- thermal resistance values
- the evaluation report number (ER-565)
- the name or logo of the inspection agency

Either IAPMO UES Mark of Conformity may also be used as shown below:



IAPMO UES ER-565

6.0 SUBSTANTIATING DATA

6.1 Data in accordance with the ICC-ES Acceptance Criteria for Spray-applied Foam Plastic Insulation, AC377, dated April 2020 (editorially revised July 2020) including Appendix X.

6.2 Flammability Testing to NFPA 286, Standard Methods of Fire Tests for Evaluation of Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.

6.3 Report of air permeance testing in accordance with ASTM E2178.

6.4 Report of water vapor transmission performance in accordance with ASTM E96.

6.5 Fire-resistance testing to ASTM E119.

6.6 Report of fire-propagation characteristics tests in accordance with NFPA 285.

6.7 Third party engineering analysis for extension of NFPA 285 results.

6.8 IAPMO/ANSI ES1000-2020, Standard for Building Code Compliance of Spray-Applied Polyurethane Foam.

6.9 Data in accordance with 2019 ICC 1100 Standard for Spray-applied Polyurethane Foam Plastic Insulation.

6.10 Test reports are from laboratories in compliance with ISO/IEC 17025.

7.0 STATEMENT OF RECOGNITION

This evaluation report describes the results of research completed by IAPMO Uniform Evaluation Service on Heatlok® HFO Pro to assess conformance to the codes and standards shown in Section 1.0 of this report and documents the product's certification. The product is manufactured at location noted in Section 2.9 of this report under a quality control program with periodic inspections under the supervision of IAPMO UES

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



EVALUATION REPORT

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TABLE 2 - ALTERNATIVE THERMAL BARRIER ASSEMBLY

FIRE-PROTECTIVE COATING/COVERING ¹			MAXIMUM SPF THICKNESS (inch)	
TYPE	MINIMUM THICKNESS	THEORETICAL APPLICATION RATE (COATINGS ONLY)	WALLS AND VERTICAL SURFACES	CEILING AND OVERHEAD SURFACES
DC315 ²	18 mils WFT (12 mils DFT)	1.1 gal/100 ft ²	7.5	11.5
Blazelok TBX ³	18 mils WFT (12 mils DFT)	1.1 gal/100 ft ²	7.5	11.5

For SI: 1 inch = 25.4 mm, 1 gallon = 3.785 L, 1 ft² = 0.0929 m²

¹ Fire-protective coatings and coverings shall be applied over all exposed SPF surfaces in accordance with the coating/covering manufacturer's instructions and this report.

² International Fireproof Technology, Inc, recognized in [IAPMO UES ER-499](#).

³ ICP Construction, recognized in ICC-ES ESR-3997

TABLE 3 – NFPA 285 COMPLYING EXTERIOR WALL ASSEMBLIES WITH HEATLOK® HFO PRO IN WALL CAVITY

Wall Component	Materials
Base Wall System (BWS)- Use either 1, 2, or 3	1. Concrete Wall. 2. Concrete Masonry Wall. 3. 1 layer of 5/8-inch-thick Type X gypsum wallboard installed on the interior side of minimum 3 5/8-inch deep, minimum 25-gauge equivalent thick steel studs spaced a maximum of 24 inches on center. Lateral bracing installed minimum every 4 foot vertically or as required.
Perimeter Fire Barrier System Use 1 and 2	1. Perimeter fire barrier system complying with Section 715.4 of the IBC shall be installed, as applicable, to fill the void between the edge of the concrete floor slab and the interior surface of the exterior wall assembly. 2. 4 pcf mineral wool in each stud cavity at each floor line, attached with Z-clips or friction fit.
Interior Insulation – Use either 1, 2, 3, 4 or 5 or combinations of 3 with 4 or 3 with 5.	1. None 2. Maximum of 3 5/8-inch thickness of Heatlok® HFO Pro applied to interior surface of BWS 1 and 2¹ 3. Full wall stud cavity depth or less of Heatlok® HFO Pro applied using exterior gypsum sheathing of BWS 3 as the substrate and covering the width of the cavity and the inside of the steel wall stud framing flange. 4. Fiberglass batt insulation (faced or unfaced). 5. Mineral wool insulation (faced or unfaced).
Exterior Sheathing	5/8-inch-thick exterior type gypsum sheathing (for BWS 3 above).
Exterior wall covering ² – use either 1, 2 or 3	1. Any non-combustible exterior wall covering material using any standard installation technique. 2. Any non-combustible exterior wall covering system with a combustible water-resistive barrier (WRB) that has successfully been tested in accordance with NFPA 285. 3. Any combustible exterior wall covering system with or without a combustible WRB that has successfully been tested in accordance with NFPA 285. 4. Table 4 below – Exterior Insulation 2 only with Claddings 6, 7 and 8 per Table 4 of this report (SPF as Exterior Insulation). Read notes carefully. 5. Table 4 below – Exterior Insulation 3 (with coating) only with Cladding 9 thru 18 per Table 4 of this report (SPF as Exterior Insulation). Read notes carefully.
Flashing of windows, doors, and other exterior wall penetrations	As an option, flash around windows, doors, and other exterior wall penetrations with limited amounts of maximum 12-inch-wide flashing tape (acrylic, asphalt or butyl based) or liquid applied membrane material with or without fiber mesh reinforcement.
Window Perimeter	The window header, jambs and sill are covered with 0.080-inch aluminum flashing. The edges and top of the assembly were sealed with steel flashing. Windows and Doors shall be framed as required for the base wall.

For SI: 1 inch = 25.4 mm; 1 lb/ft³ = 16 kg/m³

¹ Fireblocking per Section 718 of the 2021, 2018, 2015, and 2012 IBC and Section 717 of the 2009 IBC and thermal barrier material requirements must be met for BWS 1 and 2, as required by specific wall construction details when combustible concealed space is created on the exterior side of the exterior wall assembly.

² Combustible exterior wall coverings shall be installed in accordance with manufacturer's installation requirements.



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TABLE 4 – NFPA 285 COMPLYING EXTERIOR WALL ASSEMBLIES WITH HEATLOK® HFO INSTALLED ON THE EXTERIOR SIDE OF THE WALL ASSEMBLY

Wall Component	Materials
Base Wall System (BWS)- Use either 1, 2, or 3	- Concrete Wall. - Concrete Masonry Wall. 1 layer of 5/8-inch-thick Type X gypsum wallboard installed on the interior side of minimum 3 5/8-inch deep, minimum 25-gauge equivalent thick steel studs spaced a maximum of 24 inches on center. Lateral bracing installed minimum every 4 foot vertically or as required.
Perimeter Fire Barrier System Use 1 or 2.	- Perimeter fire barrier system complying with Section 715.4 of the IBC shall be installed, as applicable, to fill the void between the edge of the concrete floor slab and the interior surface of the exterior wall assembly. - Wall stud cavities shall be filled at each floor line with minimum 4 lb/ft³ mineral wool friction fit between steel wall studs, attached with Z-clips or friction fit.
Interior Insulation – Use either 1, 2, 3, 4 or 5 or combinations of 3 with 4 or 3 with 5.	- None - Full wall stud cavity depth or less of Heatlok® HFO Pro applied using exterior gypsum sheathing of BWS 3 as the substrate and covering the width of the cavity and the inside of the steel wall stud framing flange.¹ - Fiberglass batt insulation (faced or unfaced) - Mineral wool insulation (faced or unfaced)
Exterior Sheathing – use either 1 or 2	- None (for BWS 1 or 2 above) 5/8-inch thick Type X exterior type gypsum sheathing (for BWS 3 above)
Exterior Insulation Use 1, 2, or 3	- Maximum 3 1/2-inch thickness of Heatlok® HFO Pro (with Claddings 1-5, 2-inch maximum air gap between cladding and SPF). - Maximum 3-inch HeatLok HFO Pro SPF (with Claddings 6, 7 and 8. Horizontal purlin every 2 feet maximum, no vertical Z girts. Purlin depth 1-inch deeper than SPF thickness. 1-inch maximum air gap between cladding and SPF. - Maximum 3 3/4-inch HeatLok HFO Pro (with Claddings 9-18, use coating – 18 mils WFT DC315 with nine mils WFT Sherwin Williams Sher-Cryl HPA Topcoat with horizontal Z Girts 28 inches on center. 2-inch maximum air gap between cladding and SPF.
Exterior wall covering – use any item 1-20 with specific insulation or coating – read carefully. IMPORTANT Use 1-5 only with Exterior Insulation 1 Use 6, 7 and 8 only with Exterior Insulation 2 Use 9-18 only with Exterior Insulation 3 1-inch maximum air gap between cladding and SPF for cladding 6, 7 and 8 and insulation 2. 2-inch maximum air gap with cladding 1-5 or claddings 9 through 18. (continued on next page)	For use with Exterior Insulation 1 - Brick – Standard type brick veneer anchors, installed a maximum of 24 inches on center, vertically on each stud with maximum 1-inch air gap between exterior insulation and brick. Brick to be standard nominal 4-inch thick clay brick installed in a running bond pattern using Type S mortar. - Stucco – Minimum 3/4-inch thick, exterior plaster and lath. A secondary water resistive barrier (WRB) can be installed between the exterior insulation and lath. The secondary WRB shall not be full coverage asphalt or butyl based self-adhered membranes. - Minimum 2-inch thick natural stone (granite, limestone, marble or sandstone) Any standard non-open joint installation technique shall be used. - Minimum 1 1/2-inch thick concrete masonry unit (CMU), precast concrete or artificial cast stone. Any standard non-open jointed method shall be used. - Minimum 1 1/4-inch thick terra cotta non-open jointed. Any standard non-open jointed installation technique shall be used. For use with Exterior Insulation 2 - Vertical or horizontal flat 20 gauge minimum steel (or zinc galvanized steel) panels directly attached to horizontal purlin. Non-open joint. - STK 1000, STK 1500 Force Five, STK 2000, STK 2500 Force Five, STK 5000 or STK 5500 Force Five panels or equivalent. Non-open joint. - Vertical or horizontal corrugated 20 gauge minimum steel (or galvanized steel) panels (2-inch maximum corrugation depth) directly attached to horizontal purlin with no air gap (between cladding and SPF) at the shallowest depth of corrugation profile. Non-open joint. For use with Exterior Insulation 3 - Aluminum cladding – 3 mm minimum thickness, open or non-open joint. - Steel cladding – 0.0149-inch minimum thickness, open or non-open joint. - Copper cladding – 0.0216-inch minimum thickness, open or non-open joint. - Zinc cladding – 4 mm minimum thickness, open or non-open joint. 1/4-inch minimum fiber cement cladding, open or non-open joint



EVALUATION REPORT

Number: **565**

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	14. Concrete – minimum 1-inch thick, open or non-open joint. 15. Concrete Masonry Units – minimum 1-inch thick open or non-open joint 16. Stone Veneer – minimum 1-inch thick, open or non-open joint. 17. One Coat Stucco – 3/8-inch minimum exterior cement plaster and lath, non-open joint. 18. Thin Brick adhered (with noncombustible mortar) to stucco base (minimum 3/4-inch) non-open joint.
Flashing of window, door and other exterior wall penetrations	As an option, flash around window, door and other exterior wall penetrations with limited amounts of maximum 12-inch wide flashing tape (acrylic, asphalt, or butyl based) or liquid applied membrane material with or without fiber mesh reinforcement.
Window Perimeter	Materials for Openings Perimeters For Exterior Insulations 1 or 2 with no coating over the foam, use 18 gauge minimum sheet steel perimeter flashing. Windows and doors shall be framed as required for the base wall. For Exterior Insulation 3 with the coating over the foam, use 26 gauge minimum aluminum perimeter flashing. Windows and doors shall be framed as required for the base wall.

For SI: 1 inch = 25.4 mm; 1lb/ft³=16 kg/m³

¹Fireblocking per Section 718 of the 2021, 2018, 2015, and 2012 IBC and Section 717 of the 2009 IBC and thermal barrier material requirements must be met for BWS 1 and 2, as required by specific wall construction details when combustible concealed space is created on the interior side of the exterior wall assembly.



ICC-ES Evaluation Report

ESR-4073

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Subject to renewal August 2026

This report also contains:

- CA Supplement

- SI Supplement

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DIVISION: 07 00 00— THERMAL AND MOISTURE PROTECTION Section: 07 21 00— Thermal Insulation	REPORT HOLDER: HUNTSMAN BUILDING SOLUTIONS, LLC	EVALUATION SUBJECT: HEATLOK® HFO HIGH LIFT SPRAY FOAM INSULATION	
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1.0 EVALUATION SCOPE

1.1 Compliance with the following codes:

- 2024, 2021, 2018, 2015, 2012 and 2009 International Building Code® (IBC)
- 2024, 2021, 2018, 2015, 2012 and 2009 International Residential Code® (IRC)
- 2024, 2021, 2018, 2015, 2012 and 2009 International Energy Conservation Code® (IECC)

Properties evaluated:

- Surface-burning characteristics
- Physical properties
- Thermal resistance
- Attic and crawl space installation
- Water vapor transmission
- Air permeability
- Exterior walls in Types I through IV construction

1.2 Evaluation to the following green standard:

- 2008 ICC 700 National Green Building Standard™ (ICC 700-2008)

2.0 USES

Heatlok® HFO closed cell spray foam is a spray-applied polyurethane foam plastic insulation used as a nonstructural thermal insulating material in all Types of construction (Types I, II, III, IV and V) under the IBC; and in dwellings under the IRC. The insulation is intended for use in wall cavities, floor/ceiling assemblies, the underside of on-grade slabs, or attics and crawl spaces when installed in accordance with Section 4.4. Under the IRC and 2024, 2021, 2018 and 2015 IBC, the insulation may be used as air-impermeable insulation when installed in accordance with Section 3.5.

The insulation may be used in exterior walls of Type I, II, III or IV construction when used as described in Section 4.5.

The attributes of the insulation have been verified as conforming to the provisions of ICC 700-2008 Section 703.2.1.1.1(c) as an air impermeable insulation. Note that decisions on compliance for those areas rest with the user of this report. The user is advised of the project-specific provisions that may be contingent upon meeting specific conditions, and the verification of those conditions is outside the scope of this report. These codes or standards often provide supplemental information as guidance.

3.0 DESCRIPTION

3.1 General:

Heatlok[®] HFO product is a rigid, medium-density, spray-applied cellular polyurethane foam plastic insulation installed as a component of wall assemblies, ceilings, floors, crawlspaces and cavities of roofs. The foam plastic insulation is a two-component, closed-cell, one-to-one by volume spray foam system with a nominal density of 2.0 pcf (32 kg/m³). The insulation is produced in the field by combining a polymeric isocyanate (A component) with a polymeric resin blend (B component). The insulation components have a shelf life of six months when stored in factory-sealed containers at temperatures between 50°F (10°C) and 80°F (26°C). The Heatlok[®] HFO product meets or exceeds the minimum requirements set forth in Section 2603.1.1 of the 2024 and 2021 IBC.

3.2 Surface-burning Characteristics:

Heatlok[®] HFO product, at a maximum thickness of 4 inches (102 mm) and a nominal density of 2.0 pcf (32 kg/m³), has a flame spread index of 25 or less and a smoke-developed index of 450 or less when tested in accordance with ASTM E84 (UL 723). There are no thickness limitations when insulation is covered by a code-prescribed 15-minute thermal barrier.

3.3 Thermal Resistance (R-values):

Heatlok[®] HFO product has thermal resistance (R-value), at a mean temperature of 75°F (24°C), as shown in [Table 1](#).

3.4 Vapor Permeance:

Heatlok[®] HFO has a vapor permeance of 1.0 perm or greater and less than 10 perms when applied at a minimum of 1 inch (25.4 mm) thickness and may be used where a Class III vapor retarder is required by the applicable code.

3.5 Air Permeability:

Heatlok[®] HFO foam plastic insulation, at a minimum 1-inch (25.4 mm) thickness, is considered air-impermeable insulation in accordance with 2024, 2021, 2018, 2015 and 2012 IRC Section R806.5 (2009 IRC Section R806.4) and 2024, 2021 and 2018 IBC Section 1202.3 (2015 IBC Section 1203.3) based on testing in accordance with ASTM E283.

3.6 DC 315 Intumescent Coating:

DC 315 intumescent coating (see [ESR-3702](#)), manufactured by International Fireproof Technology, Inc., is a water-based coating supplied in 5-gallon (19L) pails and 55-gallon (208L) drums and has a shelf life of one (1) year when stored in factory-sealed containers at temperatures between 50°F (10°C) and 80°F (24°C).

4.0 DESIGN AND INSTALLATION

4.1 General:

Heatlok[®] HFO product must be installed in accordance with the manufacturer's published installation instructions and this report. A copy of the manufacturer's published installation instructions must be available at all times on the jobsite during installation.

4.2 Application:

The insulation is spray-applied on the jobsite using equipment identified in the manufacturer's published installation instructions. The Huntsman Building Solutions Heatlok[®] HFO product must be applied when the ambient and substrate temperature is between 10°F (-12°C) and 120°F (49°C). The insulation must not be used in areas that have a maximum service temperature greater than 180°F (82°C). The foam plastic insulation must not be used in electrical outlet or junction boxes or in contact with rain or water. The substrate must be free of moisture, frost or ice, loose scales, rust, oil and grease, or contaminants that will interfere with adhesion of the spray foam insulation. The Huntsman Building Solutions Heatlok[®] HFO product may be applied in passes having a maximum thickness of 6½ inches (165 mm) per pass. When multiple passes are required, subsequent passes can be sprayed once the core temperature drops below 100°F (37.7°C).

4.3 Thermal Barrier:

4.3.1 Application with a Prescriptive Thermal Barrier: Heatlok[®] HFO insulation must be separated from the interior of the building by an approved thermal barrier of ½-inch-thick (12.7 mm) gypsum wallboard or an equivalent thermal barrier complying with and installed in accordance with the applicable code except where the installation complies with the requirements set forth in Section 4.3.2. When installation is within an attic or crawl space as described in Section 4.4, a thermal barrier is not required between the foam plastic and the attic or crawl space, but is required between the insulation and the interior of the building.

There is no thickness limit when installed behind a code-prescribed thermal barrier except as noted in Section 4.4.2.1.

4.3.2 Application without a Prescriptive Thermal Barrier: Heatlok® HFO spray foam insulation may be installed without the prescriptive 15-minute thermal barrier or ignition barrier described in Section 4.3.1 or Section 4.4.1, respectively, when installation is in accordance with the following:

4.3.2.1 The insulation must be covered on all surfaces with the intumescent coating specified in Section 3.6 at the minimum coating thickness specified in Table 2.

4.3.2.2 The maximum installed thickness of the insulation must not exceed the insulation thickness specified in Table 2.

4.3.3 The intumescent coating must be applied over the insulation in accordance with the coating manufacturer's instructions, ICC-ES evaluation report ESR-3702 for the coating and this report.

4.4 Ignition Barrier – Attics and Crawl Spaces:

4.4.1 Application with a Prescriptive Ignition Barrier: When Heatlok® HFO insulation is installed within attics or crawl spaces where entry is made only for service of utilities, an ignition barrier must be installed in accordance with IBC Section 2603.4.1.6 and 2024 IRC Sections R303.5.3 and R303.5.4 (2021, 2018, 2015, 2012 and 2009 IRC Section R316.5.3 and R316.5.4), as applicable, except when the installation is in accordance with Section 4.4.2. The ignition barrier must be consistent with the requirements for the type of construction required by the applicable code, and must be installed in a manner so that the foam plastic insulation is not exposed. The attic or crawl space area must be separated from the interior of the building by an approved 15-minute thermal barrier as described in Section 4.3.1.

Heatlok® HFO insulation, as described in this section, may be installed in unvented attics in accordance with 2024, 2021, 2018, 2015 and 2012 IRC Section R806.5 (2009 IRC Section R806.4) or 2024, 2021 and 2018 IBC Section 1202.3 (2015 IBC Section 1203.3).

4.4.2 Application without a Prescriptive Ignition Barrier: Where the spray-applied insulation is installed in accordance with Section 4.4.2.1, the following conditions apply:

- a) Entry to the attic or crawl space is to only service utilities, and no storage is permitted.
- b) There are no interconnected attic or crawl space areas.
- c) Air in the attic or crawl space is not circulated to other parts of the building.
- d) Attic ventilation is provided when required by 2024, 2021 and 2018 IBC Section 1202.2 (2015, 2012 and 2009 IBC Section 1203.2) or IRC Section R806, except when air-impermeable insulation is permitted in unvented attics in accordance with the 2024, 2021 and 2018 IBC Section 1202.3 (2015 IBC Section 1203.3) or 2024, 2021, 2018, 2015 and 2012 IRC Section R806.5 (2009 IRC Section R806.4), as applicable.
- e) Under-floor (crawl space) ventilation is provided when required by 2024, 2021 and 2018 IBC Section 1202.4 [2015 IBC Section 1203.4 (2012 and 2009 IBC Section 1203.3)] or IRC Section R408.1, as applicable.
- f) Combustion air is provided in accordance with *International Mechanical Code*® Section 701.
- g) If hot work is to be performed, all necessary procedures, precautions and limitations must be observed in accordance with OSHA 1926 Subpart J Standard 1926.352 requirements for hot work (welding / cutting) performed in the vicinity of combustible materials.
- h) An installation certificate with the following information must be posted at each entrance:
 - Product name and installation thickness.
 - Manufacturer name, address and contact information.
 - Installation contractor name, address and contact information.
 - Attestation that the product(s) have been installed in accordance with the manufacturer's installation instructions and the requirements of the evaluation report.
 - A notice that the certificate is not to be removed or altered.
 - A list of limitations for the space including the following:
 - Entry to the space is only to service utilities, and no storage is permitted.
 - FIRE SAFETY WARNING: If hot work is to be performed, all necessary procedures, precautions and limitations must be observed in accordance with OSHA 1926 Subpart J Standard 1926.352 requirements for hot work (welding / cutting) performed in the vicinity of combustible materials.

4.4.2.1 Application without a Prescriptive Ignition Barrier: In attics and crawl spaces, Heatlok® HFO insulation may be spray-applied to the underside of roof sheathing and/or rafters, and to vertical surfaces and the underside of floors as described in this section. The thickness of the foam plastic applied to the underside of the overhead surfaces (roof sheathing, rafters and the underside of floors) must not exceed 1 1/4 inches (286 mm). The thickness of the foam plastic applied to vertical surfaces must not exceed 7 1/4 inches (184 mm).

The attic or crawl space must be separated from the interior of the building by an approved thermal barrier as described in Section 4.3.1.

4.4.3 Use on Attic Floors: Heatlok[®] HFO insulation may be installed at a maximum thickness of 11¹/₄ inches (286 mm) between and over joists in attic floors. The Heatlok[®] HFO insulation must be separated from the interior of the building by an approved thermal barrier.

4.5 Exterior Walls of Type I, II, III and IV Construction:

4.5.1 General: When used on exterior walls of Type I, II, III, and IV construction, the assembly must comply with Section 2603.5 of the IBC and this section, and the Heatlok[®] HFO insulation must be installed at a maximum thickness described in Tables 3 and 4. The potential heat of Heatlok[®] HFO insulation is 2300 Btu/ft² (26 MJ/m²) per inch of thickness when tested in accordance with NFPA 259.

4.5.2 Specific Wall Assemblies: Wall assemblies complying with Section 4.5 must be as described in Table 3 under the 2018, 2015, 2012 and 2009 IBC and Table 4 under the 2024, 2021, 2018, 2015, 2012 and 2009 IBC.

5.0 CONDITIONS OF USE:

The Heatlok[®] HFO spray foam insulation described in this report complies with, or is a suitable alternative to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

- 5.1 The products must be installed in accordance with the manufacturer's published installations instructions, this evaluation report and the applicable code. If there are any conflicts between the manufacturer's published installation instructions and this report, this report governs.
- 5.2 The insulation must be separated from the interior of the building by an approved thermal barrier, except when installation is as described in Sections 4.3.2. A thermal barrier must be installed between the insulation and the interior space above (crawl space) or below (attic).
- 5.3 The insulation must not exceed the thicknesses noted in this report based upon the intended end use.
- 5.4 The insulation must be protected from exposure to weather during and after application.
- 5.5 The insulation must be applied by contractors authorized by Huntsman Building Solutions, LLC.
- 5.6 Use of the insulation in areas where the probability of termite infestation is "very heavy" must be in accordance with 2024, 2021, 2018, 2015, and 2009 IBC Section 2603.8 (2012 IBC Section 2603.9) or IRC Section 2024 IRC Section R305.4 (2021, 2018, 2015, 2012 and 2009 R318.4), as applicable.
- 5.7 When use is on exterior walls of buildings of Types I, II, III, and IV under the IBC, construction must be as described in Section 4.5.
- 5.8 Jobsite certification and labeling of the insulation must comply with 2024, 2021, 2018 or 2015 IRC Sections N1101.10.1 and N1101.10.1.1 (2012 IRC Sections N1101.12.1 and N1101.12.1.1 or 2009 IRC Sections N1101.4 and N1101.4.1) and 2024, 2021, 2018, 2015 and 2012 IECC Sections C303.1.1, C303.1.1.1, R303.1.1 and R303.1.1.1 (2009 IECC Sections 303.1.1 and 303.1.1.1), as applicable.
- 5.9 When installed in accordance with Section 4.4.2 of this report, the associated installation certificate(s) containing the required information referenced in Section 4.4.2 must be installed at each entrance to the crawlspace or attic, as applicable. The certificate(s) must be red in color and constructed of durable materials, such as metal, plastic, or laminated paper.
- 5.10 When used in unvented attics in accordance with Section 4.4.2 of this report, installation with a vapor diffusion port in accordance with 2024 and 2021 IBC Section 1202.3, Item 5.2 or 2024, 2021 and 2018 IRC Section R806.5, Item 5.2 is outside the scope of this report.
- 5.11 The insulation components A and B are produced in Arlington, Texas and Mississauga, Ontario, Canada, under a quality control program with inspections by ICC-ES.

6.0 EVIDENCE SUBMITTED

- 6.1 Data in accordance with the ICC-ES Acceptance Criteria for Spray-applied Foam Plastic Insulation (AC377), dated June 2023 (editorially revised June 2024), including reports of tests in accordance with AC377 Appendix X.
- 6.2 Reports of air leakage testing in accordance with ASTM E283.
- 6.3 Reports of water vapor transmission test in accordance with ASTM E96.
- 6.4 Reports of room corner tests in accordance with NFPA 286.
- 6.5 Reports of fire propagation characteristics tests in accordance with NFPA 285.
- 6.6 Reports of potential heat of foam plastic tests in accordance with NFPA 259.
- 6.7 Supplementary fire engineering analysis.

7.0 IDENTIFICATION

- 7.1 The ICC-ES mark of conformity, electronic labeling, or the evaluation report number (ICC-ES ESR-4073) along with the name, registered trademark, or registered logo of the report holder must be included in the product label.
- 7.2 In addition, components of the insulation are identified with the manufacturer's name [Huntsman Building Solutions, LLC], address and telephone number; the product name (Heatlok[®] HFO B-side or A-PDMI); use instructions; the density; the flame-spread and smoke-developed indices; and the date of manufacture; thermal resistance values.

The International Fireproof Technology, Inc. / Paint To Protect, Inc. DC 315 intumescent coating is identified with the manufacturer's name, the product trade name, use instructions and ICC-ES evaluation report number ESR-3702.

- 7.3 The report holder's contact information is the following:

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TABLE 1—THERMAL RESISTANCE (R-VALUES)

THICKNESS (inches)	R-VALUE (°F.ft ² .h/Btu)	THICKNESS (inches)	R-VALUE (°F.ft ² .h/Btu)
1.0	6.3	7.0	52
1.5	10	7.5	56
2.0	14	8.0	60
2.5	18	8.5	64
3.0	22	9.0	67
3.5	26	9.5	71
4.0	30	10.0	75
4.5	34	10.5	79
5.0	37	11.0	82
5.5	41	11.5	86
6.0	45	12.0	90

For SI: 1 inch = 25.4 mm; 1°F.ft².h/Btu = 0.176 110°K.m²/W.

¹R-values are calculated based on tested K-values at 1- and 4-inch thicknesses.

TABLE 2—USE OF INSULATION WITHOUT A PRESCRIPTIVE THERMAL BARRIER (TESTED IN ACCORDANCE WITH NFPA 286)

INSULATION TYPE	MAXIMUM THICKNESS (in.) (Vertical Surfaces)	MAXIMUM THICKNESS (in.) (Overhead Surfaces)	COATING TYPE & MINIMUM THICKNESS ^{2,3} (Applied to all Foam Surfaces)	MINIMUM APPLICATION RATE OF COATING ²
Heatlok HFO	7½	11½	DC 315 18 mils WFT 12 mils DFT	1.125 gal / 100 ft ²

For SI: 1 inch = 25.4 mm; 1 mil = 0.0254 mm; 1 gallon = 3.78 L; 1 ft² = 0.93 m².

Notes: ¹See Section 4.3.2.

²DFT = Dry Film Thickness; WFT = Wet Film Thickness

³See Section 3.6.

TABLE 3—NFPA 285 COMPLYING EXTERIOR WALL ASSEMBLIES – WALL CAVITY INSULATION ^{1,2}

WALL COMPONENT	MATERIALS
Base Wall System – Use either 1, 2 or 3	1 – Concrete wall. 2 – Concrete masonry wall. 3 – Minimum 3 ⁵ / ₈ -inch-deep (92 mm), No. 25 gage, C-shaped steel studs, spaced a maximum of 24 inches on center with lateral bracing every 4 feet (1219 mm) as required by code. Interior sheathing must be 1 layer ⁵ / ₈ -inch-thick (19.1 mm) Type X gypsum wallboard complying with ASTM C1396. Exterior Sheathing shall be as described in Exterior Sheathing below.
Floorline Firestopping	Minimum 4 pcf mineral wool in each stud cavity at each floorline, attached with Z-clips. Thickness must match stud cavity depth.
Perimeter Fire Barrier System	Perimeter fire barrier system complying with 2018, 2015 and 2012 IBC Section 715.4 (2009 IBC Section 714.4) must be installed to fill the void between the edge of the concrete floor slab and the interior surface of the exterior wall assembly.
Cavity / Interior Insulation – Use either 1, 2, 3, 4 or 5; (Note: Cavity Insulation No. 3 may be combined with No. 4 or Cavity Insulation No. 3 may be combined with No. 5 to achieve depth of insulation required)	1 – None. 2 – 3 ⁵ / ₈ inches (92 mm) of Heatlok® HFO applied to the interior surface of Base Wall System 1 or 2 ^a . 3 – Full cavity depth not exceeding 3 ⁵ / ₈ inches (92 mm) of Heatlok® HFO. 3 – Any insulation qualified as noncombustible in accordance with ASTM E136. 4 – Glass fiber batt insulation ^b . 5 – Mineral fiber insulation ^b . ^a Fireblocking in accordance with 2018, 2015 and 2012 IBC Section 718 (2009 IBC Section 717) and thermal barrier material requirements in accordance with IBC Section 2603.4 shall be met for Base Wall Systems 1 and 2, when a combustible concealed space is present on interior side of the exterior wall assembly. ^b Insulation must comply with the applicable requirements of 2018, 2015 or 2012 IBC Section 720.2 (2009 IBC Section 719.2).
Exterior Sheathing – Only for Base Wall System No.3 –	Minimum ⁵ / ₈ -inch-thick (19.1 mm) glass mat gypsum sheathing complying with ASTM C1177. Sheathing shall be attached with No. 6, 1 ¹ / ₄ -inch-long (32 mm) self-tapping screws located 8 inches (203 mm) on center along the perimeter and 12 inches (302 mm) on center in the field of wallboard. Joints must be taped and treated with joint compound in accordance with ASTM C840 or GA-216.
Exterior Wall Covering – Use either 1 or 2	1 – Any noncombustible exterior wall covering material using any standard installation technique (Base Wall 1 or 2) 2 – Any noncombustible exterior wall covering system with a combustible WRB that has successfully been tested in accordance with NFPA 285. (Base Wall 3) Details of the exterior wall covering must be provided to the code official by the report holder, designer or specifier, with an engineering analysis demonstrating that (1) the exterior wall covering conforms to ASTM E136 and (2) the addition of the wall covering and/or water-resistive barrier to the assembly described in this section does not negatively affect conformance of the assembly with the requirements of IBC Section 2603.5.

¹ When used on exterior walls of Types I, II, III or IV construction, the specific wall assembly must comply with 2018, 2015, 2012 and 2009 IBC Section 2603.5.² The exterior wall assemblies described in Table 3 comply with 2018, 2015, 2012 and 2009 IBC Section 2603.5.5.TABLE 4—NFPA 285 COMPLYING EXTERIOR WALL ASSEMBLIES – WALL CAVITY INSULATION ^{1,2}

WALL COMPONENT	MATERIALS
Base Wall System –	1–Minimum 3 ⁵ / ₈ -inch-deep (92 mm), No. 20 gage, C-shaped steel studs, spaced a maximum of 24 inches (610 mm) on center with lateral bracing every 4 feet (1219 mm) as required by code. Interior sheathing must be 1 layer ⁵ / ₈ -inch-thick (19.1 mm) Type X gypsum wallboard complying with ASTM C1396. Exterior Sheathing shall be as described in Exterior Sheathing below.
Floorline Firestopping	Minimum 4 pcf mineral wool in each stud cavity at each floorline, attached with Z-clips. Thickness must match stud cavity depth.
Perimeter Fire Barrier System	Perimeter fire barrier system complying with 2024, 2021, 2018, 2015 and 2012 IBC Section 715.4 (2009 IBC Section 714.4) must be installed to fill the void between the edge of the concrete floor slab and the interior surface of the exterior wall assembly.
Cavity / Interior Insulation	None
Exterior Sheathing	Minimum ¹ / ₂ -inch-thick (12.7 mm) glass mat gypsum sheathing complying with ASTM C1177. Sheathing shall be attached with No. 6, 1 ¹ / ₄ -inch-long (32 mm) self-tapping screws located 8 inches (203 mm) on center along the perimeter and 12 inches (302 mm) on center in the field of wallboard. Joints must be taped and treated with joint compound in accordance with ASTM C840 or GA-216.
Exterior Insulation	Maximum 8-inch-thick (203 mm) Heatlok® HFO insulation.
Exterior Wall Covering	Nominal 4-inch-thick (101.6 mm) common clay brick installed in running bond pattern in accordance with the code with a 1-inch (25.4 mm) air gap between back of brick and exterior insulation. Window opening must be flashed with minimum 0.05-inch-thick (1.3 mm) steel flashing.

For SI: 1 inch = 25.4 mm.

¹ When used on exterior walls of Types I, II, III or IV construction, the specific wall assembly must comply with 2024, 2021, 2018, 2015, 2012 and 2009 IBC Section 2603.5.² The exterior wall assemblies described in Table 4 comply with 2024, 2021, 2018, 2015, 2012 and 2009 IBC Section 2603.5.5.

DIVISION: 07 00 00—THERMAL AND MOISTURE PROTECTION

Section: 07 21 00—Thermal Insulation

REPORT HOLDER:

HUNTSMAN BUILDING SOLUTIONS, LLC

EVALUATION SUBJECT:

HEATLOK® HFO HIGH LIFT SPRAY FOAM INSULATION

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that the Heatlok® HFO High Lift Spray Foam Insulation, described in ICC-ES evaluation report [ESR-4073](#), has also been evaluated for the codes noted below.

Applicable code editions:

- 2025 California Building Code (CBC)

For evaluation of applicable chapters adopted by the California Office of Statewide Health Planning and Development (OSHPD) AKA: California Department of Health Care Access and Information (HCAI) and the Division of the State Architect (DSA), see Sections 2.1.1 and 2.1.2 below.

- 2025 California Residential Code (CRC)
- 2025 California Energy Code (CEC)

2.0 CONCLUSIONS

2.1 CBC and CRC:

The Heatlok® HFO High Lift Spray Foam Insulation, described in Sections 2.0 through 7.0 of the evaluation report [ESR-4073](#), complies with the 2025 CBC and CRC, provided the design and installation are in accordance with the 2024 *International Building Code*® (IBC) and 2024 *International Residential Code*® (IRC) provisions noted in the evaluation report.

2.1.1 OSHPD:

The applicable OSHPD Sections and Chapters of the CBC are beyond the scope of this supplement.

2.1.2 DSA:

The applicable DSA Sections and Chapters of the CBC are beyond the scope of this supplement.

2.2 CEC:

The Heatlok® HFO High Lift Spray Foam Insulation, described in Sections 2.0 through 7.0 of the evaluation report [ESR-4073](#), complies with the 2025 CEC, provided the design and installation are in accordance with the 2024 *International Building Code*® (IBC) provisions noted in the evaluation report.

2.2.1 Conditions of Use:

In accordance with Section 110.8 of the 2025 California Energy Code, verification of certification by the Department of Consumer Affairs, Bureau of Household Goods and Services, must be provided to the code official, demonstrating that the insulation conductive thermal performance is approved pursuant to the California Code of Regulations, Title 24, Part 12, Chapters 12-13, Article 3, "Standards for Insulating Material." Certification can be verified with the DCA Bureau of Household Goods and Services using the following link to the bureau's Directory of Certified Insulation Materials: https://bhgs.dca.ca.gov/consumers/ti_directory.pdf

This supplement expires concurrently with the evaluation report, reissued August 2025 and revised April 2026.

ICC-ES Evaluation Report

ESR-4073 Seal & Insulate with
ENERGY STAR® Supplement

Reissued August 2025

Revised April 2026

This report is subject to renewal August 2026.

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A Subsidiary of the International Code Council®

DIVISION: 07 00 00—THERMAL AND MOISTURE PROTECTION

Section: 07 21 00—Thermal Insulation

REPORT HOLDER:

HUNTSMAN BUILDING SOLUTIONS, LLC

EVALUATION SUBJECT:

HEATLOK® HFO HIGH LIFT SPRAY FOAM INSULATION

1.0 EVALUATION SCOPE

Conformance to the following:

Seal and Insulate with ENERGY STAR Program, *Definitions and Testing Requirements for Residential Insulation, Version 1.0*

Properties evaluated:

- Thermal resistance
- Surface-burning characteristics

2.0 PURPOSE OF THIS SUPPLEMENT

This supplement is issued to certify that the Heatlok® HFO High Lift Spray Foam Insulation described in Sections 2.0 through 7.0 of the evaluation report (ESR-4073) have been reviewed for compliance with the applicable codes noted in Section 1.0 of the evaluation report and with the requirements set forth in the Seal and Insulate with ENERGY STAR Program, *Definitions and Testing Requirements for Residential Insulation, Version 1.0*. The insulation product covered by this supplement is defined as "Spray Foam Insulation."

The requirements for testing laboratory qualifications and product sampling, as well as the specific material and test standards and editions used in this evaluation, are as set forth in the applicable documentation noted in Section 6.0 of the evaluation report.

ICC-ES, the Certification Body, has verified that the test results were issued by laboratories accredited as required by the Conditions and Criteria for Recognition of Insulation Certification Bodies for the ENERGY STAR Program.

3.0 DEFINITIONS

The following definitions are from the Definitions and Testing Requirements for Residential Insulation, Version 1.0, and are applicable to the subject of this report.

3.1 General Definition:

Insulation: Any material mainly used to slow down heat flow. It may be mineral or organic, fibrous, cellular, or reflective (aluminum foil). It may be in rigid, semi-rigid, flexible, or loose-fill form.

Residential Buildings: Single family homes (attached or unattached), multifamily buildings with 4 units or fewer, or multifamily buildings (e.g., condominiums and apartments) with 3 stories or less in height above grade.

3.2 Insulation Product Definition:

Spray or Pour Foam Insulation: A thermal insulating material that is sprayed or poured (as a gel or foamy liquid) into place and expands or sets into a cellular foam and cures at the point of installation through a chemical reaction. Foamed materials include, but are not limited to polyurethane, polyisocyanurate, phenolic, and cementitious insulation.

3.3 Insulation Performance Definitions:

R-value: The inverse of the time rate of heat flow through a body from one of its bounding surfaces to the other surface for a unit temperature difference between the two surfaces, under steady state conditions, per unit area. For the purposes of the Seal and Insulate with ENERGY STAR program, only Imperial units will be accepted [(h·ft²·°F)/Btu].

Smoke-Development Index: The characteristic of a material to emit smoke when exposed to flame or fire compared to heptane and inorganic cement.

Flame-Spread Index: The characteristic of a material to resist the spreading of flames when exposed to flame or fire compared to red oak and inorganic cement.

4.0 Insulation Performance:**4.1 Thermal Resistance:**

The Heatlok® HFO High Lift Spray Foam Insulation has the thermal resistance *R*-values as noted in Table 1 of ESR-4073, based upon testing.

4.2 Surface Burning Characteristics:

Smoke-Development Index: See Section 3.2 of ESR-4073 for the smoke-development index of the insulation material.

Flame-Spread Index: See Section 3.2 of ESR-4073 for the flame-spread index of the insulation material.

5.0 Installation:

Installation of the Heatlok® HFO High Lift Spray Foam must be in accordance with the requirements set forth in Sections 4.0 and 5.0 (as applicable) of ESR-4073 and Huntsman Building Solution's Installation Instructions dated October 8, 2024, which are reprinted on pages 11 through 31. The installation instructions address use in the following locations of the residence:

- Above grade wall (inside)
- Above grade wall (outside)
- Below grade wall (inside)
- Crawlspace wall (under house)
- Roof or rafters (cathedral ceiling)
- Attic floor
- Attic knee wall
- Ceiling of basement or crawlspace

This supplement expires concurrently with the evaluation report, reissued August 2025 and revised April 2026.



RESIDENTIAL SPRAY FOAM PRODUCT APPLICATION GUIDE FOR HOMEOWNERS

OVERVIEW OF HEALTH AND SAFETY FACTORS TO TAKE INTO ACCOUNT WHEN USING SPRAY POLYURETHANE FOAM (SPF)

This application guide pertains to the spray polyurethane foam insulation products offered by Huntsman Building Solutions for residential use. It serves as a general reference for homeowners. Contractors are advised to consult the complete Application Guides for each specific product to obtain detailed installation parameters and requirements. When applying SPF, it is essential to prioritize health and safety. The subsequent sections address potential hazards associated with SPF application, the proper handling of chemical components, safety practices on the job site, and the necessary personal protective equipment for handling and installing SPF chemicals. This information is derived from the Center for Polyurethane Industries' Guidance on Best Practices for the Installation of Spray Polyurethane Foam, which can be accessed at <https://www.americanchemistry.com>. For more extensive information regarding the health and safety considerations of SPF, additional resources, guidance documents, and training materials are available at www.spraypolyurethane.org.

QUALITY ASSURANCE – INSTALLER QUALIFICATIONS

Only contractors authorized by Huntsman Building Solutions in the art of applying spray polyurethane foam insulation can install the products.

OVERVIEW OF SPRAY POLYURETHANE FOAM'S COMPONENT MATERIALS HEALTH RISKS

Spray polyurethane foam insulation is created through the combination of methylene diphenyl diisocyanate (MDI) and a polyol mixture. Given that these materials may pose health risks, only contractors approved by Huntsman Building Solutions in the application of spray polyurethane foam insulation, and equipped with the appropriate personal protective equipment (PPE) as outlined below, are permitted to handle and install these products. For a visual summary of the required PPE for applicators and assistants, please refer to Figure 1. For further details regarding potential health effects, consult the Material Safety Data Sheets (MSDS) for A-PMDI and B-Side Resin provided by HBS.

RESPIRATORY PROTECTION

In the course of application, the concentration of airborne chemicals may surpass the established exposure guidelines. Consequently, access to the work area and the handling of raw materials is restricted to trained and authorized contractors equipped with appropriate personal protective equipment (PPE). Indoor applications generally necessitate the use of Supplied Air Respirators (SAR), while outdoor applications may call for Air Purifying Respirators. For additional guidance on selecting respirators, please consult the NIOSH Respirator Decision Logic, which is accessible online at www.cdc.gov/niosh/docs/2005-100/pdfs/05-100.pdf.

EYE PROTECTION

It is essential to wear suitable eye protection to safeguard the eyes from accidental splashes of liquids, reactive foams, and other aerosols and particulates that may be encountered during application. When dealing with liquid SPF chemicals in open containers, workers should utilize safety goggles or a combination of safety goggles and face shields to shield their eyes. Additionally, during the application of SPF, eye protection can be enhanced by using a hooded or full-face respirator. Furthermore, having a portable eyewash station readily accessible in the rig or truck, as well as in the immediate work area, and ensuring it is properly covered, can provide additional safety.

CLOTHING & GLOVES

Workers are required to don suitable protective attire whenever there is a risk of direct exposure to SPF component chemicals, particularly during the handling of raw materials and the application of SPF. Applicators and their assistants generally utilize disposable coveralls to prevent spray and mist from coming into contact with their skin and clothing. Fabric gloves that are completely coated with nitrile, neoprene, butyl, or PVC are usually effective in safeguarding SPF applicators. To ensure adequate skin protection, personal protective equipment (PPE) must be worn in a way that leaves no skin exposed.

RE-ENTRY & RE-OCCUPANCY TIMES FOR INTERIOR APPLICATIONS

Only trained, approved and properly protected workers can access the work area during application and for a determined period afterwards. The work area shall be ventilated in accordance with applicable guidance, notably the US Environmental Protection Agency (EPA)'s "Ventilation Guidance for Spray Polyurethane Foam Application", the American Chemistry Council's Center for the Polyurethanes Industry's "Good Practices – Engineering Controls and Ventilation", as well as Federal Regulations for Safety and Health during Construction. Re-entry periods for sprayers, helpers, informed trade workers and contractors will vary depending on the product and ventilation rate being used. For homeowners and building occupants, Huntsman Building Solutions recommends a 24-hour re-occupancy time after the application of SPF when appropriate ventilation is used. Homeowners are encouraged to visit www.spraypolyurethane.org and www.huntsmanbuildingsolutions.com for up to date information about spray foam application standards.

Figure 1 – PPE Guidance for applicators and helpers

High Pressure High Pressure Spray Systems	
	
Routes of Exposure	PPE
Eyes	 or  FF Mask/ Hood
Skin	Full Body Suits  Full Suit
Hands	Gloves 
Lungs	Air Supply  or  FF Mask/ Hood or FF Air Purifying Airline OV/Pre-filter Provide Good Ventilation

GENERAL PROCESSING GUIDELINE

HBS spray polyurethane foam (SPF) insulation requires heat from the proportioner to complete the chemical reactions necessary to create foam meeting the specifications on the Technical DataSheet. Fully functional primary heaters and hose heat are needed to process the materials. Please consult the Huntsman Building Solutions Technical Service Department for further assistance.

SUBSTRATE PREPARATION

All surfaces to be sprayed must be free of oil, grease, waxes, rust scale, loose dirt and water. In addition, the substrate must be structurally sound. The moisture content of wood substrates must not exceed 19% before foam is applied. Some metal surfaces may require sandblasting and priming prior to foam spraying to ensure adequate adhesion. Consult a Huntsman Building Solutions Technical Service Representative for additional information on surface preparation. When in doubt about the potential for adhesion to a substrate, build a mock-up and spray the foam under similar conditions to that expected in the field, then test for adhesion and cohesion.

Applying foam insulation to concrete:

- Concrete and masonry must be fully cured and "bone-dry."
- Oils – wash with detergent and allow to dry
- Salt or calcium deposits – wash with detergent and allow to dry
- Muriatic acid can be an effective cleaning agent for preparing concrete substrates prior to spraying foam. Follow the label instructions for dilution and application.

Applying foam insulation to galvanized steel:

- Oils or passivators – clean with solvent, wash with water based cleaner/degreaser, brush blasting may be necessary.
- Do not use hydrocarbon solvents like mineral spirits to clean galvanized metal.
- White rust – wire brushing or scrubbing with a stiff brush or abrasive pad.
- Prime using a DTM (direct to metal) bonding primer suitable for galvanized metal.

Applying foam over previously painted surface:

- Glossy surfaces – sand or abrade surfaces.

Applying foam over bare steel/metal:

- Rust scales – wire brushing or scrubbing with a stiff brush or abrasive pad.
- Corrosion – clean then prime with suitable bonding primer.
- Glossy or very smooth surfaces – sand or abrade surfaces.

Applying foam over stainless steel:

- Oils – wash with mineral spirits and then prime with a suitable primer. Brush blasting, sanding or abrading may be necessary as foam requires a mechanical bond.

Applying foam over aluminum:

- Oils, Hydrated Alumina – clean with solvent, never use a caustic solution, and prime with a high adhesion bonding primer suitable for aluminum.

Applying foam over glass:

- Oils – wash with detergent
- Glossy or very smooth surfaces – sand or abrade surfaces.
- UV degradation – prime glass surface with suitable primer.

Asphalt and Tar:

- Solvents – allow to cure and for solvent to evaporate, prime with suitable primer.

Rigid Polyurethane Foam:

- UV degradation – remove surface of foam with wire brush or wire grinding wheel.

Polypropylene, polyethylene, some silicones and some ceramic surfaces:

- Spray polyurethane foam may not adhere without a mechanical attachment to these substrates.

FOAM APPLICATION

In preparation for spraying, workers will perform an off-target test spray to verify the processing pressure, primary heater and hose temperature settings. Foam application temperatures and pressures can vary widely depending on temperature, humidity, elevation, substrate, equipment and other factors. While processing, the applicator must continuously observe the characteristics of the sprayed foam and adjust processing temperatures and pressures to maintain proper cell structure, adhesion, cohesion and general foam quality.

Spraying sections too thick, too fast may result in charring of the foam, or in extreme conditions a fire may result. Therefore, the maximum thickness per pass and proper wait times between passes should be respected to avoid fire hazards, including spontaneous combustion, resulting from excessive heat generation. Thin foam layers often result in poor physical properties, reduced coverage and poor chemical reaction due to low exothermic heat generated from the chemical reaction, which is needed to create proper cell formation. When multiple layers are necessary to achieve the proper R-value, cross-hatching should be done. This technique aids in proper cohesion of passes.

The temperature of the substrate has a major effect on the foam density and adhesion. Certain compromises are necessary to spray in cold weather. The "COLD WEATHER PROCESSING" section offers more information on this topic. If in doubt about the substrate or the ambient conditions, a trial application should be done to check foam quality and spray performance. Water on the substrate from rain, fog, condensation, etc. will react chemically with the isocyanate, adversely affecting the physical properties, performance and adhesion of the foam. Application on substrates with high relative humidity can also adversely affect the physical properties of the foam.

EXTERIOR FOAM APPLICATION

Climatic conditions are an important factor that should be considered when preparing to apply foam to the exterior of a structure. Ambient and substrate temperatures should be monitored. Foam should only be applied when ambient and substrate temperatures are inside the range for the foam system being used. Foam should only be applied to substrates with less than 19% moisture content. It is best to apply foam when the humidity is less than 80% and the wind is less than 10 mph to maintain proper adhesion. Pay close attention to the temperature of the substrate when applying foam to the exterior of a structure.

Use windscreens downwind, the foam can travel long distances because the particles may separate when airborne. Windscreens can also be configured around scaffolding and man-lifts. It may also be necessary to enclose and preheat the area to the acceptable temperature range for the foam system being used. In preparation for spraying, a test spray should be performed to ensure that the proper processing temperatures and pressures are set. The specified settings per the TDS are general starting parameters, it is important to observe the foam and the reaction time of the reacting mass and make additional adjustments as needed.

COLD STORAGE APPLICATIONS

Cold storage facilities require vapor barriers. Vapor barriers are typically applied to the warm side of the insulation system. Closed-cell spray foam is classified as a class II vapor barrier above a certain thickness. When spraying in freezers, use 1" (25mm) lift passes. Thicker passes in deep freezers can lead to severe cracking. Freezers require closed-cell 2 lb foam, using lower density foam or an over catalyzed foam can also lead to severe cracking. Proper surface preparation may be necessary prior to the application of closed-cell spray foam in cold storage applications. Contact the Huntsman Building Solutions Technical Service Department for more information about cold storage applications.

Materials used to construct refrigerated rooms are affected by temperature changes, like all common building materials. Gradual lowering of the temperature is designed to eliminate problems stemming from these temperature changes while at the same time withdrawing construction moisture, and testing the vapor barrier and mechanical system.

HOW TO AVOID OVER SPRAY

Over spray with spray foam occurs for a variety of reasons such as spraying the product too cool, applying the product to a substrate that is too cold, not spraying perpendicular to the surface, and high wind conditions. Flash coating to warm the surface is not a recommended practice and may create unwanted over spray. Flash coats are very thin and may not have enough exothermic reaction present to properly cure. Excessive over spray may lead to blisters or delaminating of additional passes of foam or coating. Over spray can travel long distances and may adhere to objects left unprotected such as windows, buildings and automobiles. Protect anything that should not get foamed.

LIMITATIONS OF USE

Spray foam insulation described in this Application Guide is a combustible material with a maximum continuous service temperature of 180°F (82°C). Spray foam insulation should not be used in direct contact with chimneys, flues, steam pipes, recessed lighting or other heat emitting devices. Consult the listing or label of such materials for clearance to combustibles. A minimum clearance of 3" (76mm) should be maintained when applying around recessed lighting or other heat emitting devices (IRC Section R302.14), and it's important to avoid spraying inside electric outlets or junction boxes. Where factory-built chimneys pass through insulated assemblies, an insulation shield made of steel having a thickness of not less than 0.0187 inch (No 26 gage) shall be installed to provide clearance between the chimney and the insulation. Insulation shields provided as part of a listed chimney system shall be installed in accordance with the chimney manufacturer's installation instructions (IRC Section 1005.8). For applications for spray-applied insulation around ductwork, attic hatches, pull-down stairways, windows, pipes or plumbing see to the applicable code. Properly prep and secure any material or surface that should not get insulated. If in doubt about the substrate temperature or surface conditions, a trial application should be conducted to check foam quality and spray performance. Water on the surface from rain, fog, condensation, etc. will react chemically with the isocyanate, adversely affecting the foam and physical properties, particularly adhesion.

COLD WEATHER PROCESSING

Low temperatures affect the foaming process in two ways.

1. Chemical reactions can be slowed due to reduced exothermic energy within the expanding mass, which could lead to poor cell structure, dripping and voids from slow plastic formation
2. This reduced temperature often leads to reduced yield.

The temperature and type of substrate has a greater influence on the quality of the foam than the temperature of the air because the rate of heat transfer from liquid to air is much slower than the rate from liquid to substrate. If the substrate temperature is too low, or it is a highly conductive material such as metal or concrete, the heat produced by the chemical reaction may be drawn into the substrate so rapidly that plastic formation and cell generation becomes very slow, thus reducing yield. It is not a good practice to use the heated chemicals to warm the surface (flash coat). Instead, if the substrate to be sprayed is too cold to produce proper foam, the substrate should be heated using an indirect-fired heater or the foam should be sprayed on a warmer substrate on a warmer day. No open flame or direct heating is permitted during the spraying process.

THERMAL AND UV PROTECTION

Combustible spray foam insulation must be separated from the living space by a thermal barrier in accordance with applicable codes. This product must not be used when the continuous service temperature of the substrate or foam is above 180°F (82°C). Spray foam must be protected from direct exposure to sunlight; incidental exposure during construction may cause surface discoloration but will not degrade the performance of the foam.

VENTILATION

Ventilate during spray foam application and for a minimum of 24 hours following the application or until no objectionable odor remains. If not adequately ventilated during and shortly after application, the odors can be absorbed in adjacent materials such as fibrous insulation, wood framing and household or stored items. Sheet plastic should be placed over any absorbent material that cannot be removed during the spray and ventilation operation.

CHEMICAL STORAGE

Spray foam insulation's B-side resin is packaged in totes or in closed-head metal drums. A-PMDI is packaged in totes or in closed-head metal drums. Products' B-side resin and A-side isocyanate should be stored within their respective temperature ranges as described in Table 1 below. The storage temperature for containers of chemicals used to make spray foam insulation is very important. Installers storing these chemicals should refer to manufacturer information to confirm proper storage practices. The materials should be kept away from direct sunlight. The transfer pump should be removed and the bungs of the A-PMDI and B-side drum tightly closed after use. B-side resin's shelf life should be respected. See the products' B-side SDS for additional information.

LOCATIONS/APPLICATIONS

HBS offers closed-cell and open-cell spray foam products that can be used as a nonstructural thermal insulating material in some or all Types of construction (Types I, II, III, IV & V) under the IBC, and in dwellings under the IRC. Please refer to the appropriate product ESR evaluation report for the specific Types of construction each product can be used in. Closed-cell spray foam insulation can be used installed inside or outside. Such applications include, but are not limited to, external walls, within wall cavities, floor/ceiling assemblies, attics and crawl spaces when installed in accordance with applicable codes. Open-cell spray foam insulation is only intended to be used indoors and above grade. Its applications include within wall cavities, floor/ceiling assemblies and attics when installed in accordance with applicable codes. Local codes should be consulted regarding appropriate thermal and ignition barriers for use with the product where applicable. For additional information, refer to the products' respective Evaluation Service Reports on Huntsman Building Solutions' website.

UNVENTED CRAWL SPACE APPLICATIONS

HBS spray foam insulation shall be applied directly to the crawl space walls, bands of the floor system and in direct contact with framing materials. Do not use separator sheets between the insulation and the concrete/block masonry wall, as this will provide paths for air leakage around the insulated layer. Building Codes require that exposed earth in an unvented crawl space be covered with a continuous Class I Vapor Retarder to avoid excessive moisture loads in the crawl space. The Class I Vapor retarder shall be sealed or taped, its edges shall extend at least 6" up the crawl space wall and shall be attached and sealed to the wall and spray foam applied overtop to prevent any air leakage. Refer to Figure 2 for typical details.

TERMITE INSPECTION GAP

The use of insulation in "very heavy" termite infestation probability areas shall comply with 2021 IBC Section 2603.8 & 2021 IRC Section R318.4. As such, in areas where the probability of termite infestation is "very heavy", extruded and expanded polystyrene, polyisocyanurate and other foam plastics shall not be installed on the exterior face or under interior or exterior foundation walls or slab foundations located below grade. The clearance between foam plastics installed above grade and exposed earth shall be not less than 6 inches (152mm). Refer to local codes that may require a gap at the top of the foundation walls for termite inspection purposes. The SPF & Pest Management industry developed a solution to maintain building performance and permit visual termite inspection. One solution that provides the inspection gap (no foam) on the top (if required) and 6" gap on the bottom of the foundation wall is not to install spray foam over the band joist and mudsill. In this case, the framing members must be caulked at all the joints between the band joists, floor joists, the floor sheathing above, and to the top of the foundation, as can be seen on Figure 3. A non-rigid removable insulation would then be placed between the joists to insulate the band joist and the mudsill. This will allow for the periodic inspections required to maintain termite warranties/bonds. Moreover, in very heavy termite infestation areas, it is not recommended to install spray foam directly on the soil as it may be an at-risk area that would require access for visual inspection.

Figure 2

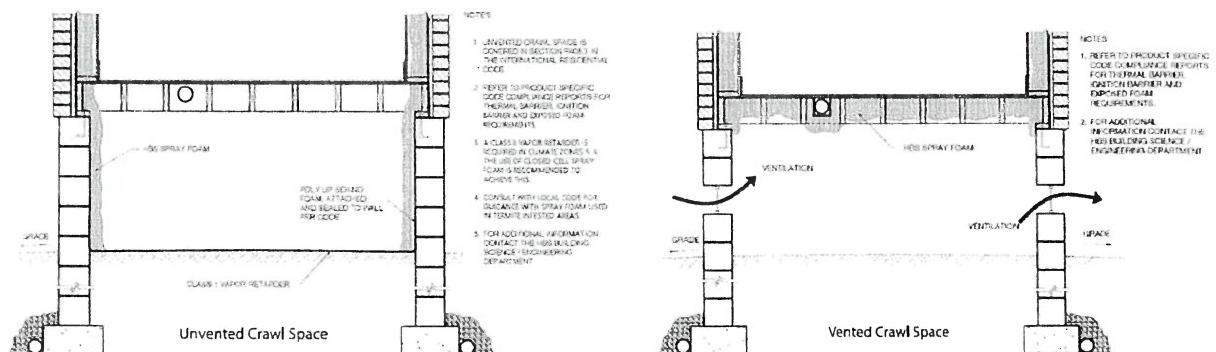
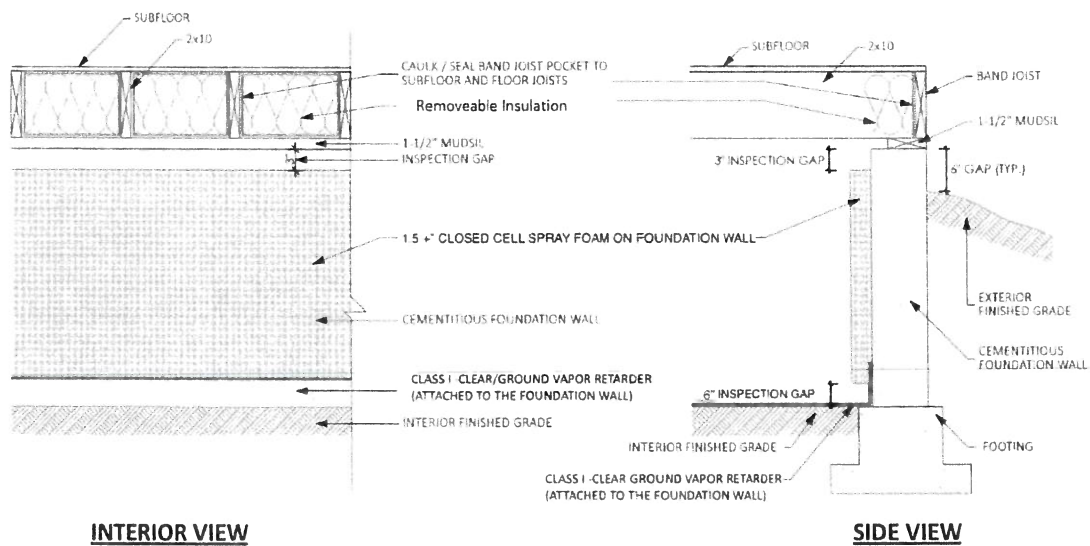


Figure 3 – Unvented/Sealed Crawlspace with 1.5" + Closed-Cell Spray Foam on Foundation Wall and Removable Insulation on Band Joist

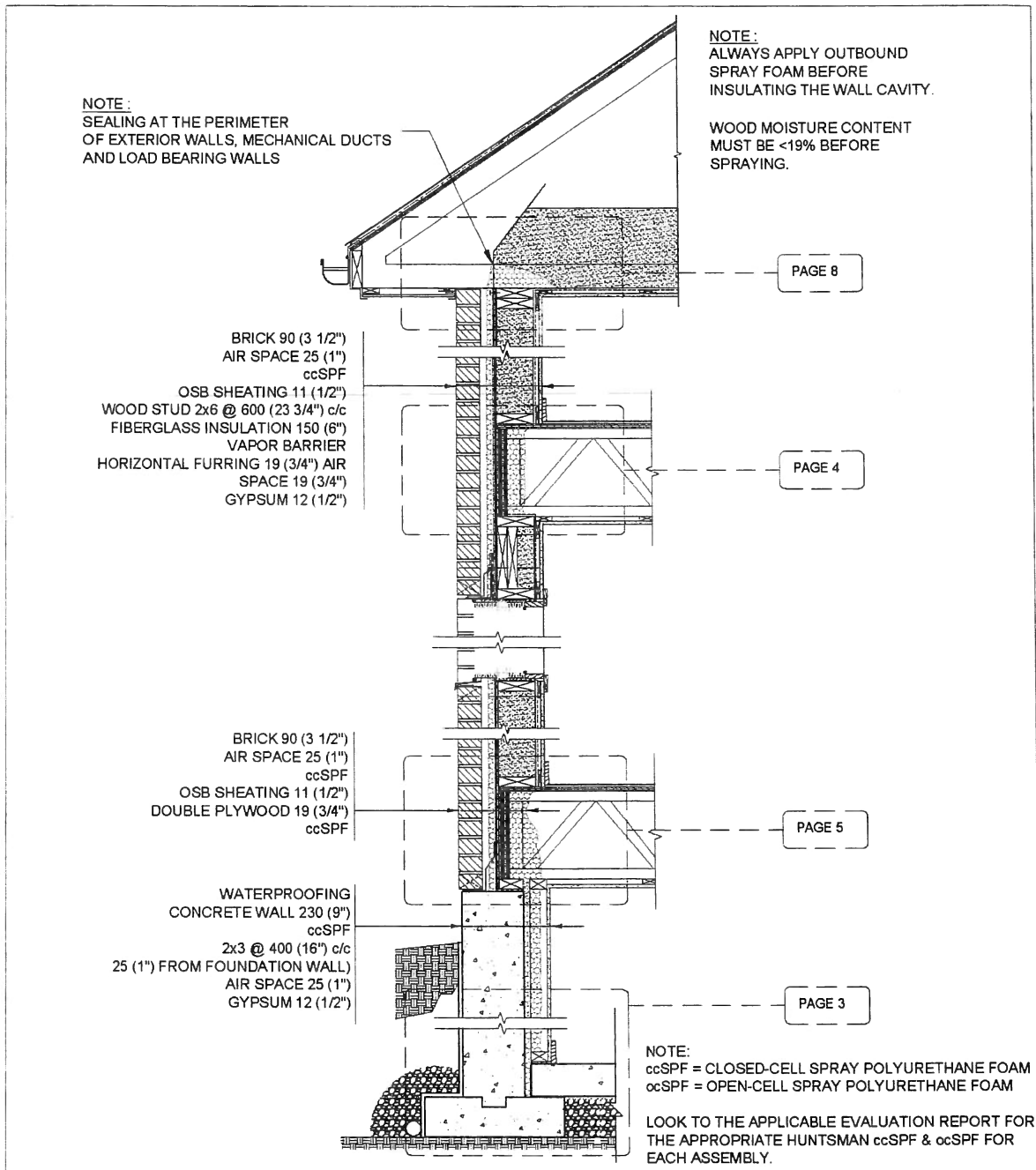
**FOR MORE INFORMATION**

Visit www.huntsmanbuildingsolutions.com or call 817-640-4900 for more information on health, safety and environmental protection with respect to polyurethane chemicals.

Disclaimer: The information herein is to assist customers in determining whether our products are suitable for their applications. We request that customers inspect and test our products before use and satisfy themselves as to contents and suitability. Nothing herein shall constitute a warranty, expressed or implied, including any warranty of merchantability or fitness, nor is protection from any law or patent inferred. All patent rights are reserved. The foam product is combustible and must be protected in accordance with applicable codes. Protect from direct flame and spark contact, around hot work for example. The exclusive remedy for all proven claims is replacement of our materials.

APPENDIX A

Construction drawings representing typical assembly details and locations where spray foam is certified to be used in residential buildings.



2x6 WALL - BRICK
SYSTEM SECTION

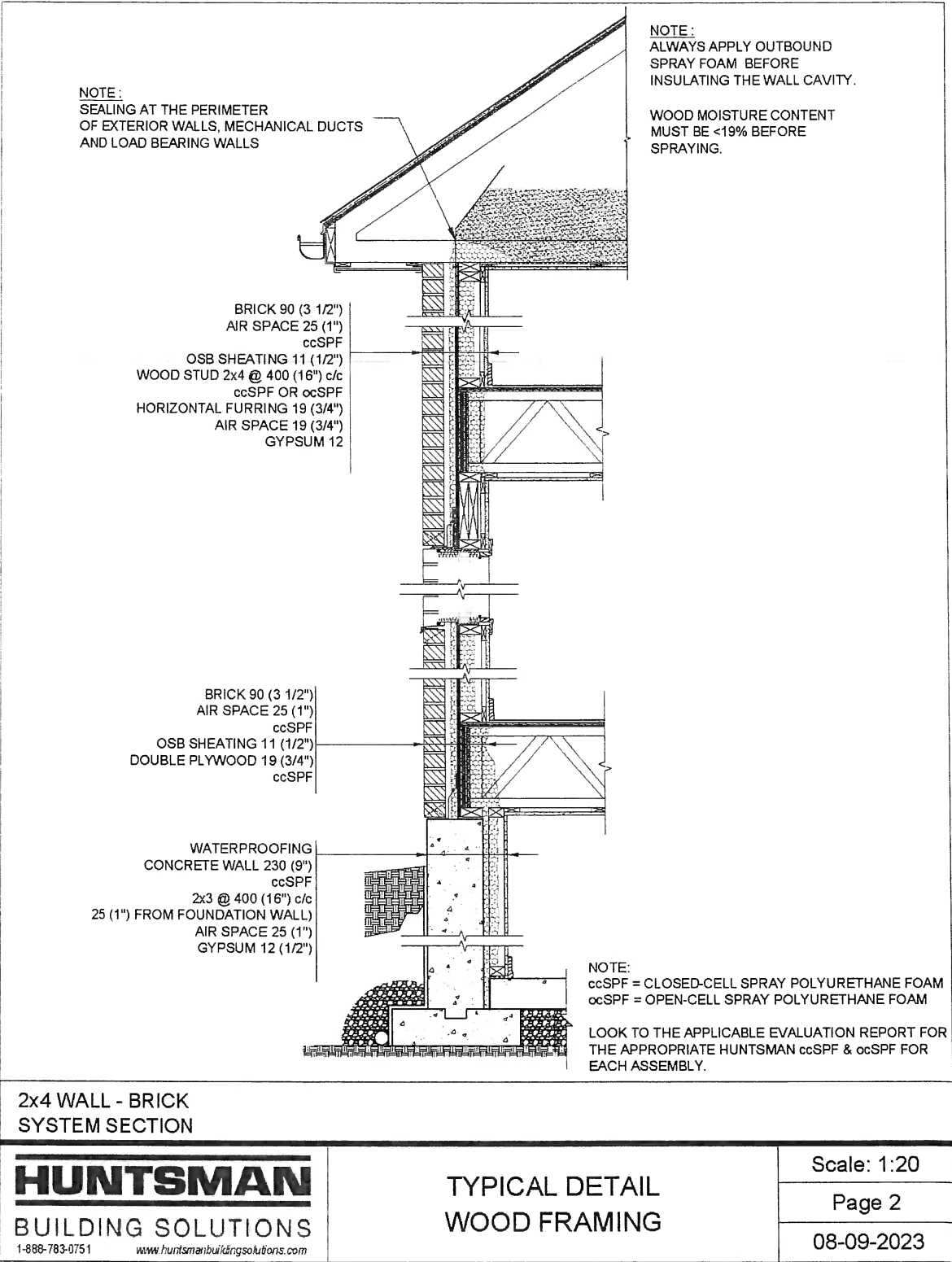
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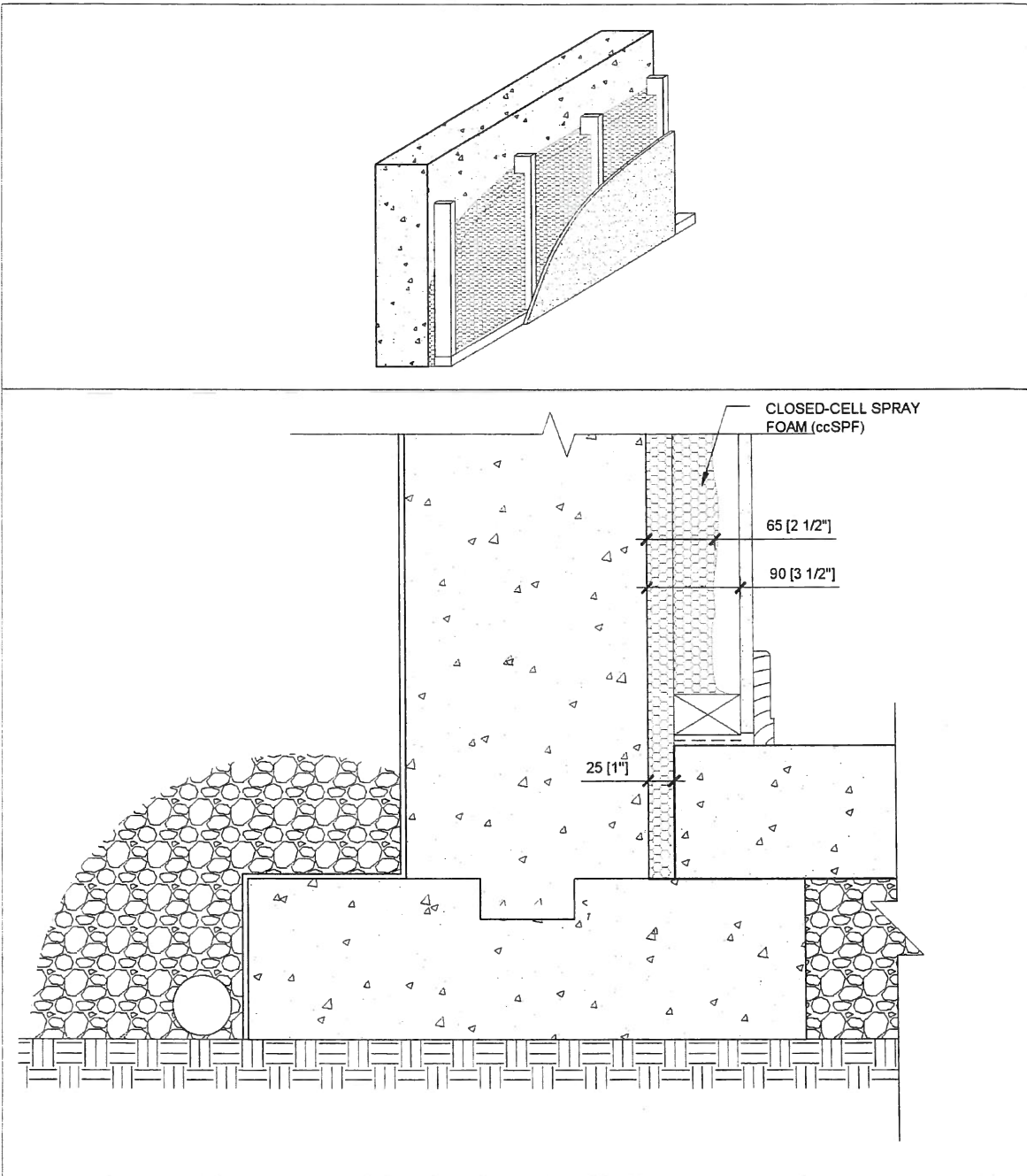
TYPICAL DETAIL
WOOD FRAMING

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Page 1

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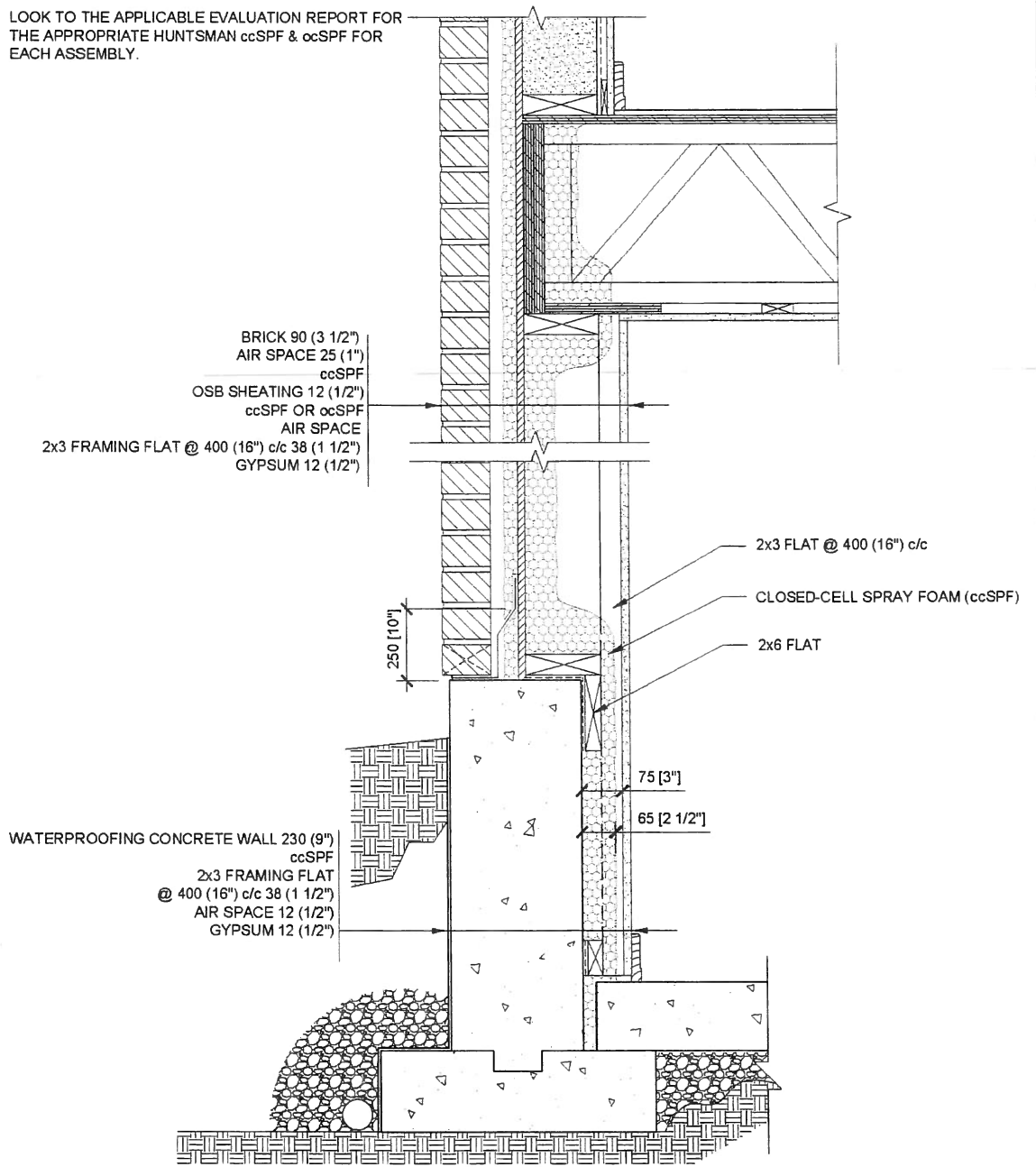
FOUNDATION

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TYPICAL DETAIL
WOOD FRAMING

Scale: 1:5
Page 3
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LOOK TO THE APPLICABLE EVALUATION REPORT FOR
THE APPROPRIATE HUNTSMAN ccSPF & ocSPF FOR
EACH ASSEMBLY.



2x6 WALL - BRICK
FOUNDATION KNEE WALL

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BUILDING SOLUTIONS
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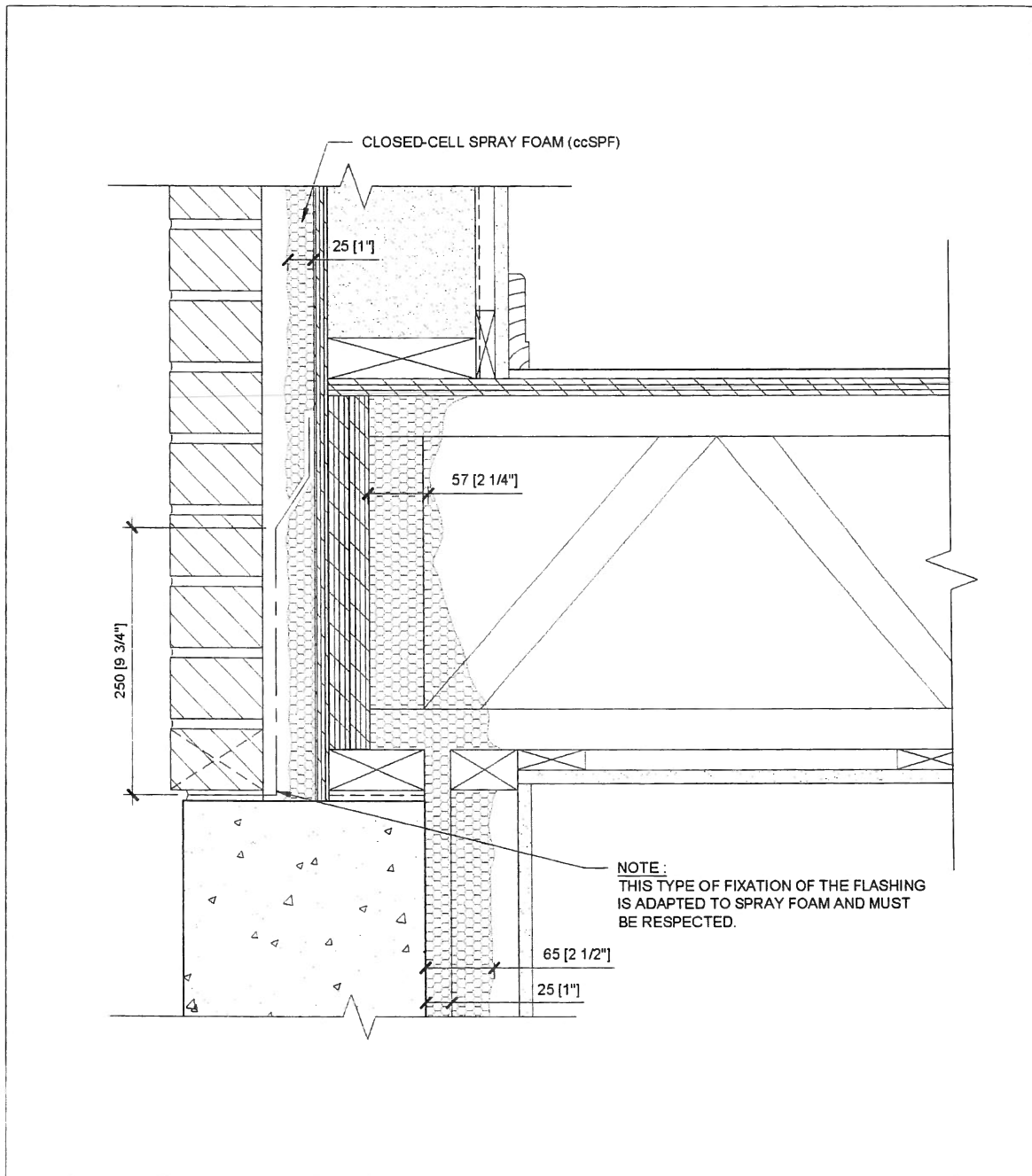
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WOOD FRAMING

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2x6 WALL - BRICK
RIM JOIST - FOUNDATION

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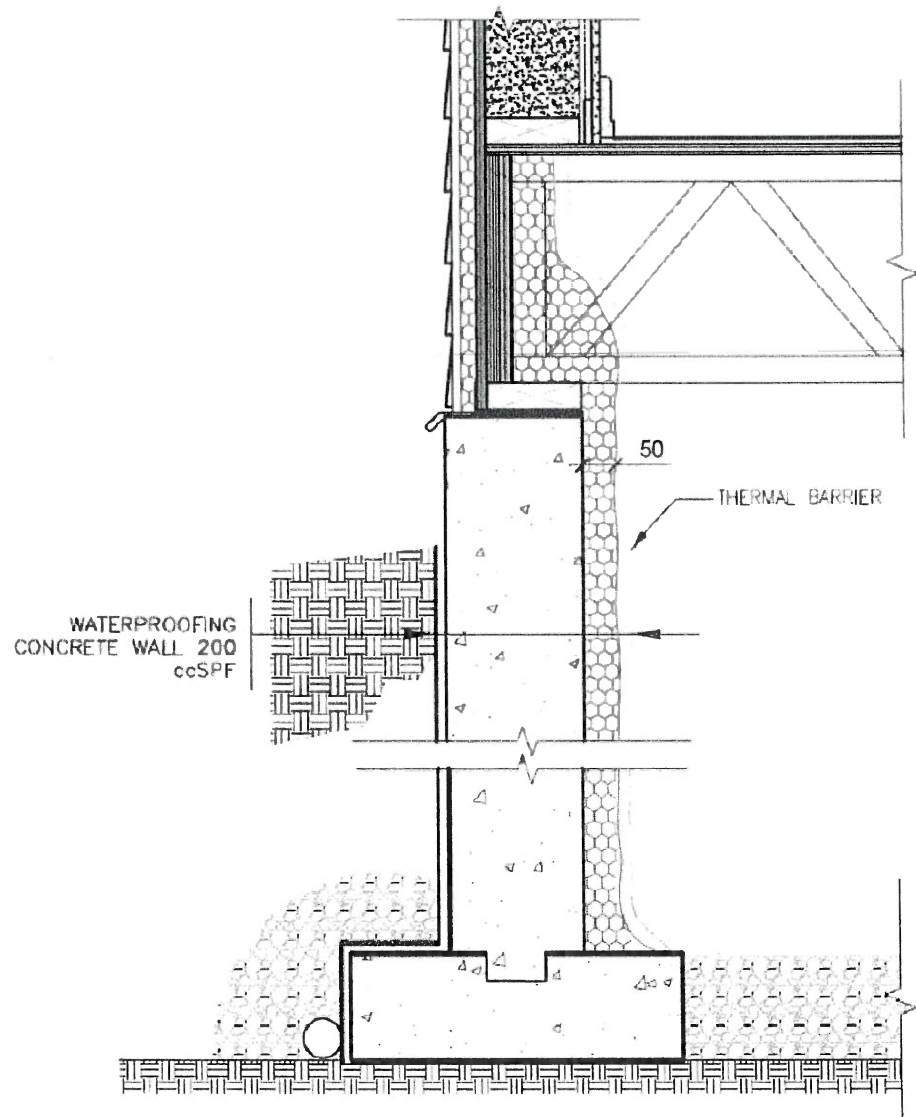
TYPICAL DETAIL
WOOD FRAMING

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NOTE:
LOOK TO THE APPLICABLE EVALUATION REPORT FOR
THE APPROPRIATE HUNTSMAN ccSPF & ccSPF FOR
EACH ASSEMBLY.

UNVENTED CRAWLSPACE

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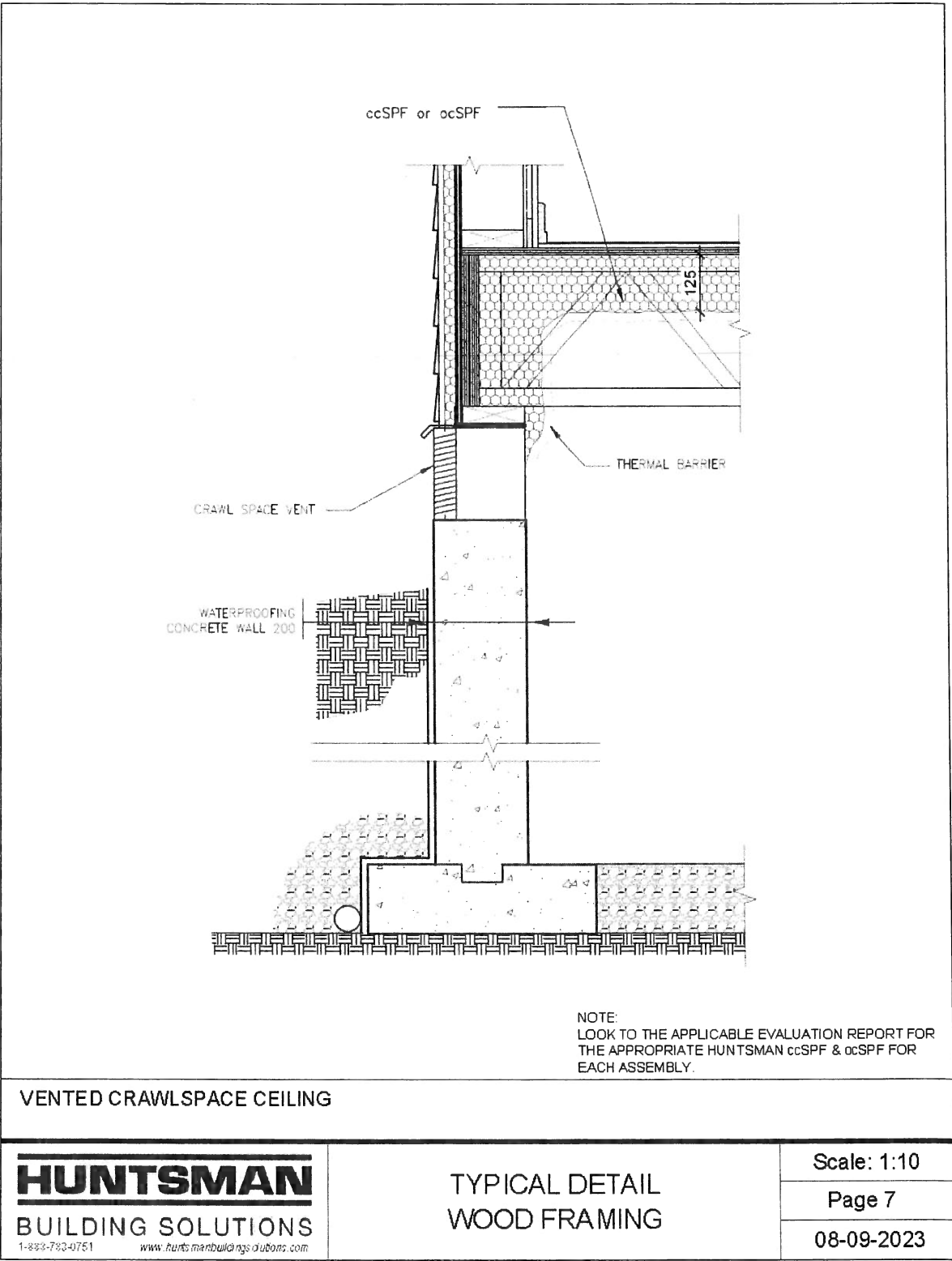
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WOOD FRAMING

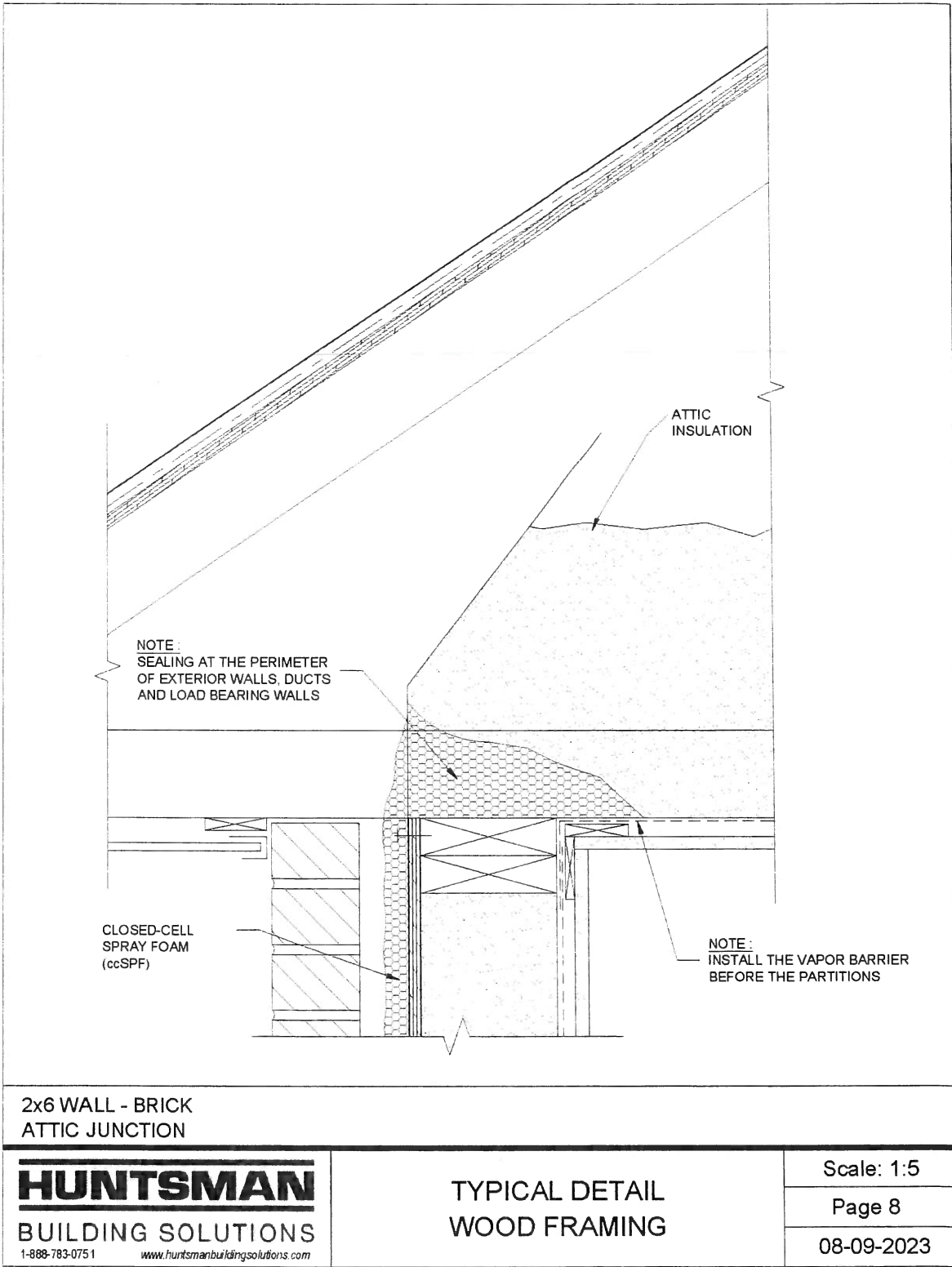
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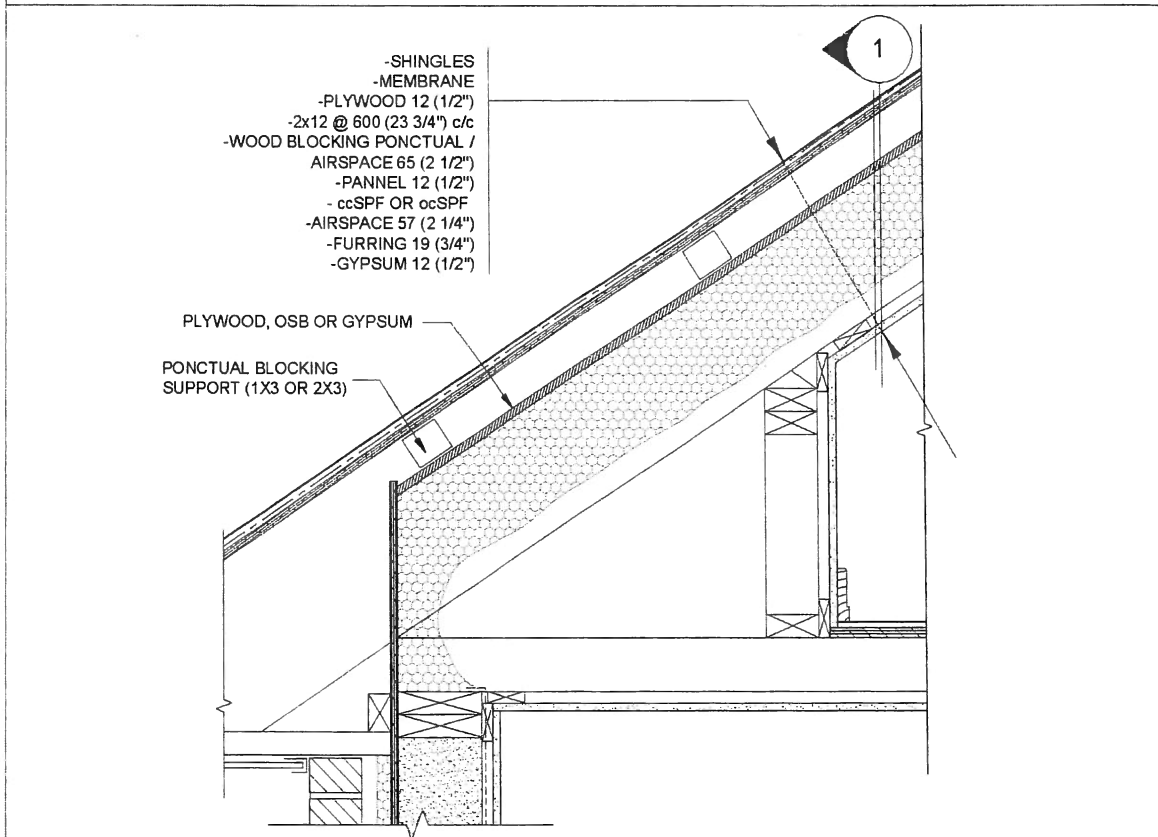
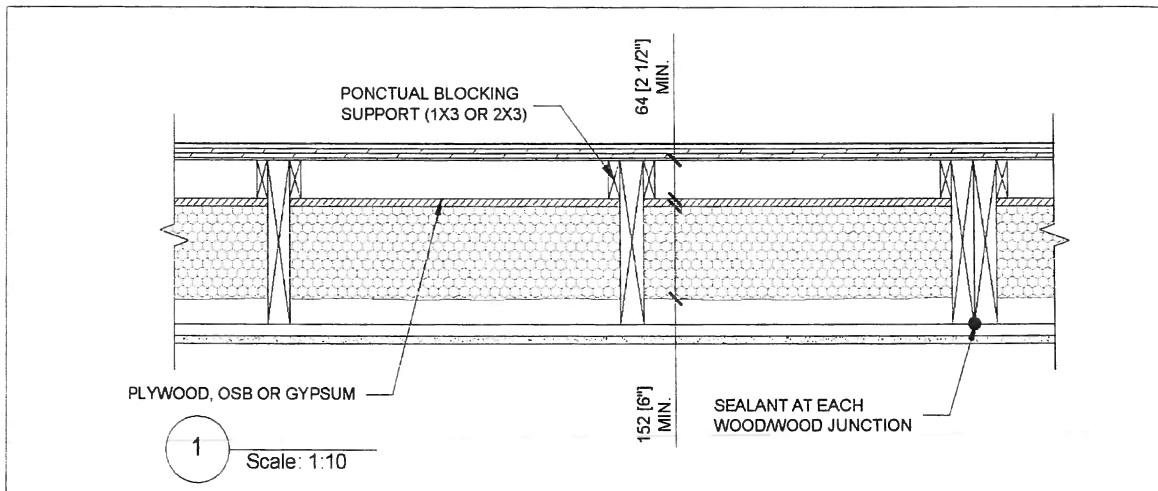
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08-09-2023

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2x6 WALL - BRICK
CATHEDRAL VENTILATED -KNEE WALL

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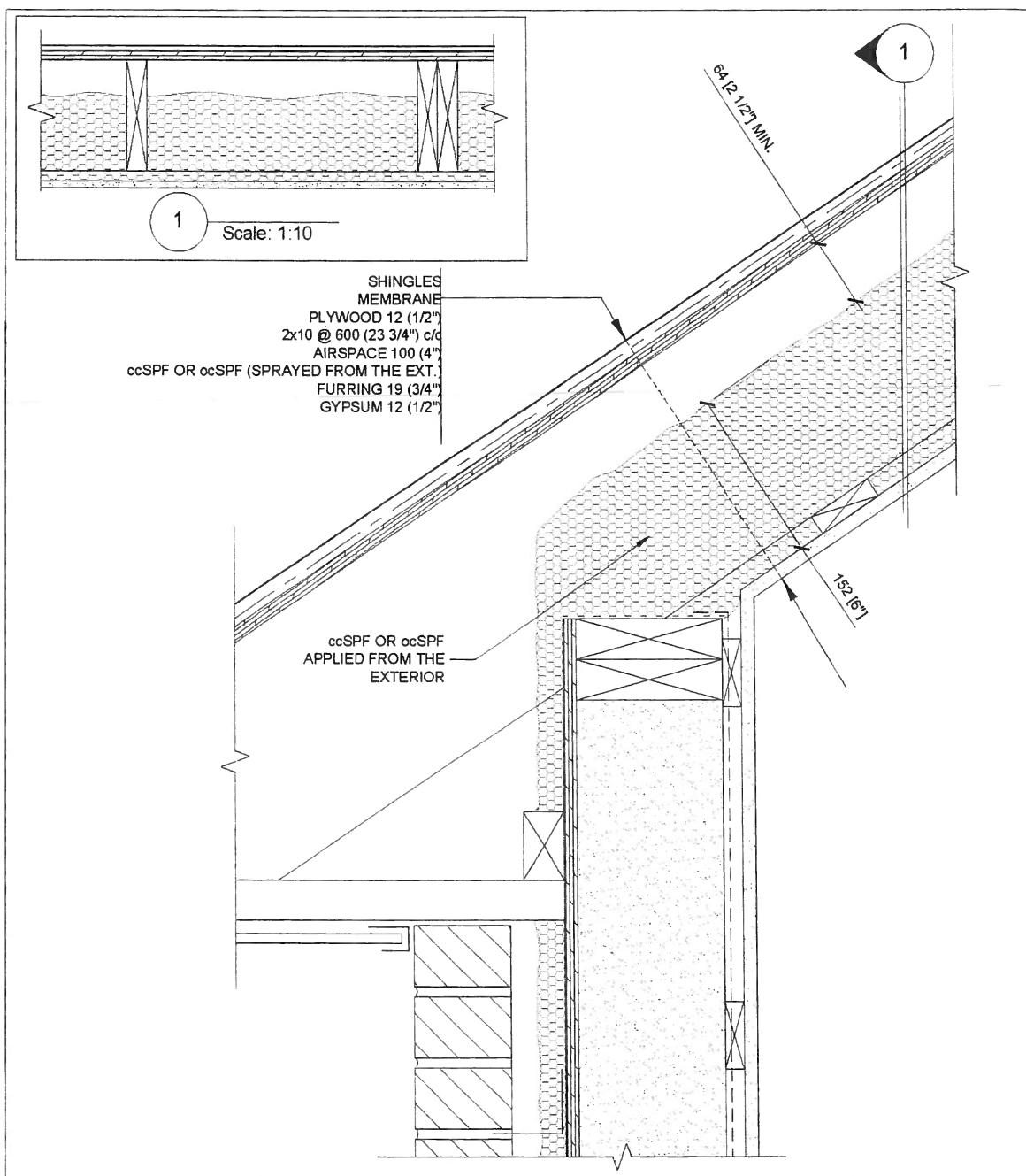
TYPICAL DETAIL
WOOD FRAMING

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08-09-2023

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2x6 WALL - BRICK
VENTILATED CATHEDRAL ROOF EXT.

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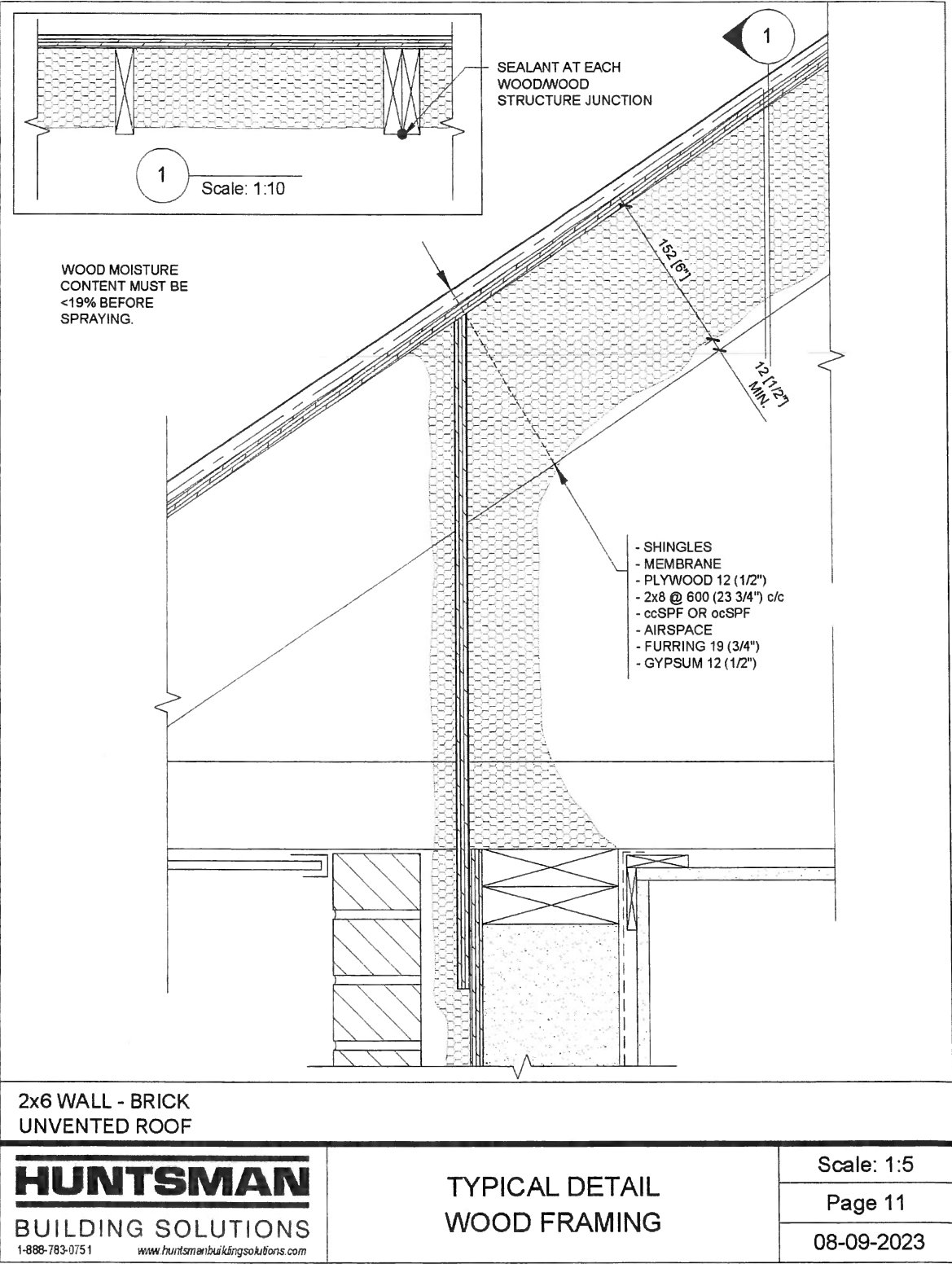
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WOOD FRAMING

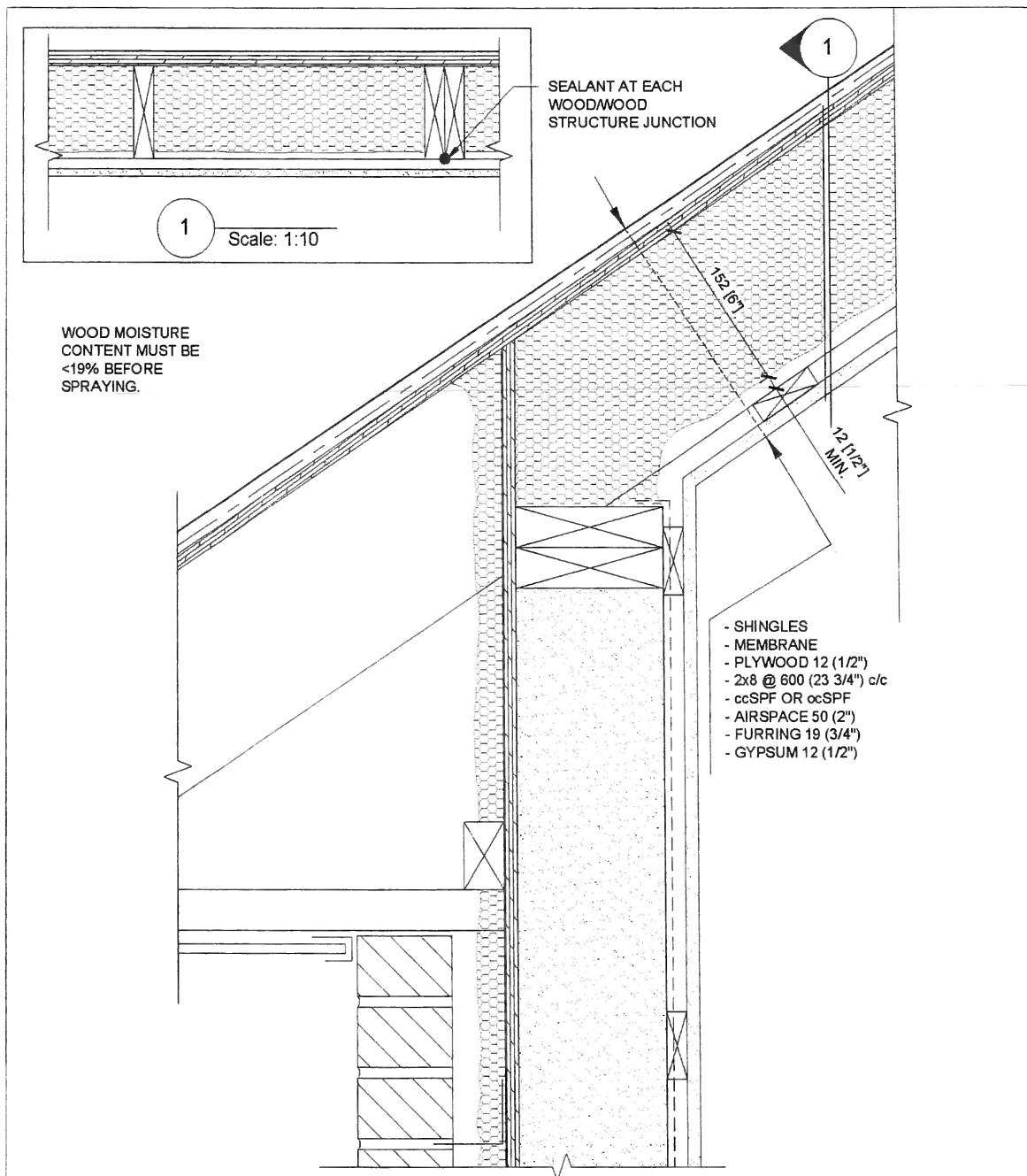
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2x6 WALL - BRICK
UNVENTED CATHEDRAL ROOF

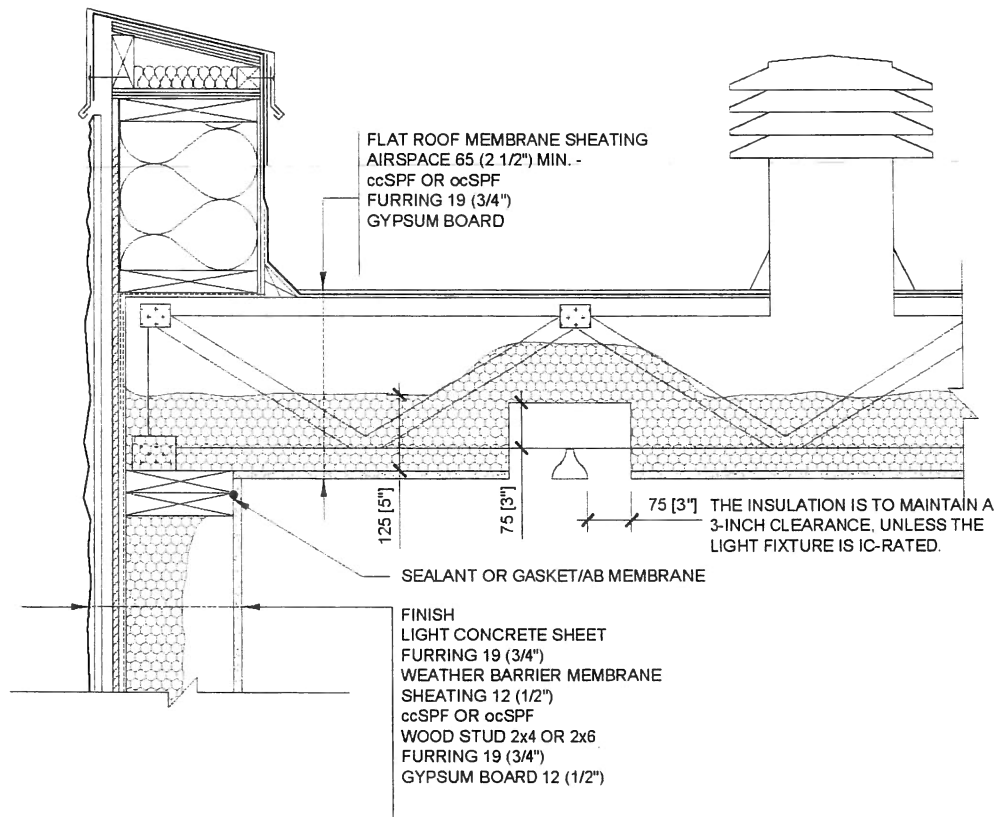
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TYPICAL DETAIL
WOOD FRAMING

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FLAT ROOF - VENTILATED

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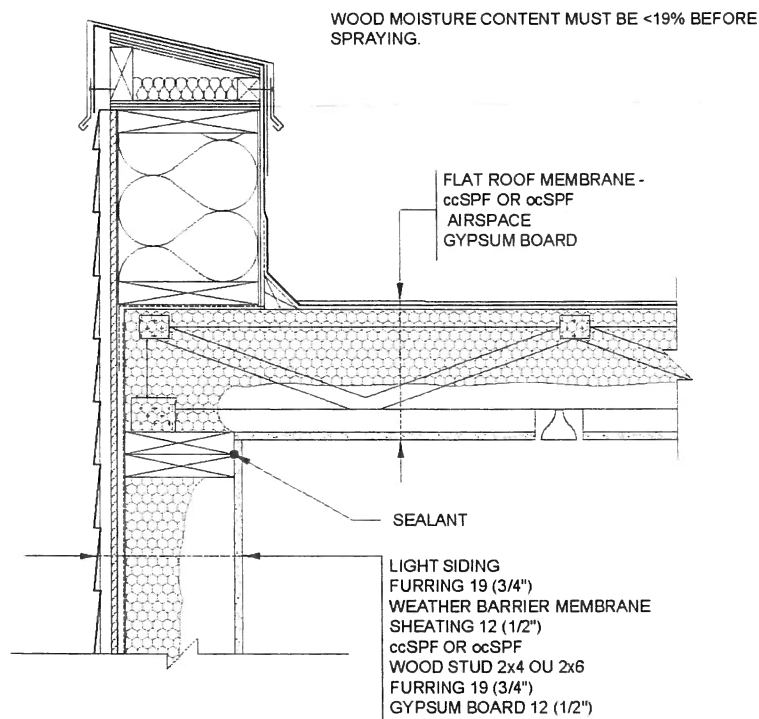
TYPICAL DETAIL
WOOD FRAMING

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FLAT ROOF - UNVENTILATED

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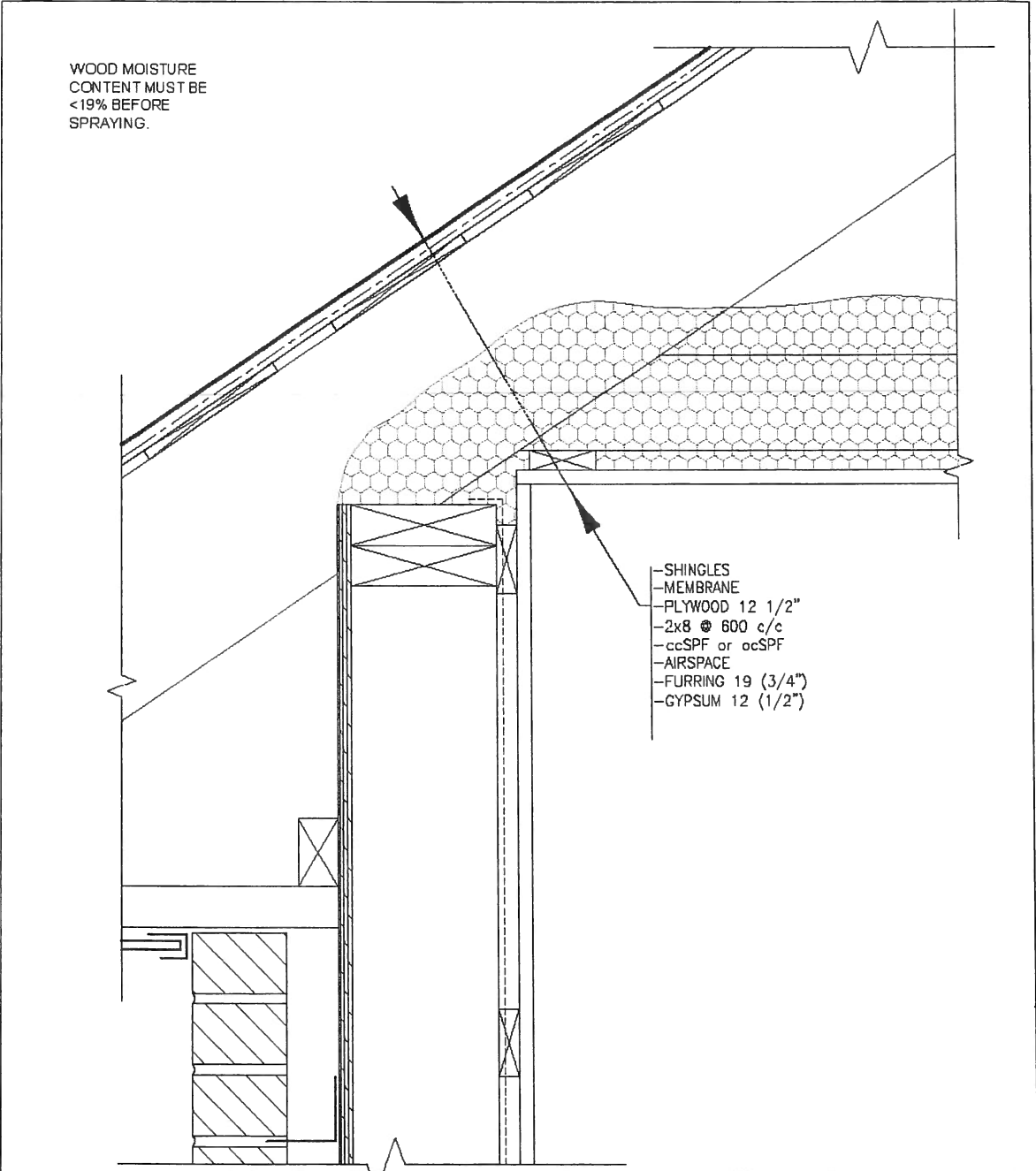
TYPICAL DETAIL
WOOD FRAMING

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INSULATION ON ATTIC FLOOR

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TYPICAL DETAIL
WOOD FRAMING

Scale: 1:10
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HEATLOK® HFO PRO

TECHNICAL DATA SHEET

Heatlok® HFO Pro is a two component, closed cell, spray applied, rigid polyurethane foam system. This product uses recycled plastic materials, rapidly renewable soy oils, and the blowing agent has zero ozone depleting potential. Heatlok HFO Pro complies with the intent of the International Code Council's residential and commercial building codes and is commonly used as a thermal insulation, air barrier, vapor retarder and water resistive barrier in above grade, below grade, interior and exterior applications.

PHYSICAL PROPERTIES			
ASTM D 1622	Core Density	2.0 lb/ft³	32.0 kg/m³
ASTM C 518	Aged Thermal Resistance	1" = 7.4 ft²h°F/BTU 1" = 1.3 Km²/W	3.5" = 23 ft²h°F/BTU 3.5" = 4.04 Km²/W
ASTM E 283	Air Leakage @ 75 Pa @ 1"	< 0.02 L/sm²	
ASTM E 2178	Air Permeance @ 75 Pa @ 1"	< 0.02 L/sm²	
ASTM E 96	Water Vapor Permeance	0.91 perms	52.5 ng/Pa•s•m²
	Class II vapor retarder per IBC Section 202 @ 1"		
	Class II vapor retarder @ ≤ 1 perm	1"	25.4mm
ASTM D 2842	Water Absorption (volume)	0.3%	
ASTM D 1621	Compressive Strength	31 psi	214 kPa
ASTM D 1623	Tensile Strength	44 psi	303 kPa
ASTM D 2126	Dimensional Stability @ 158°F (70°C) 97% R.H. (168 hours)	-3.7 (% volume change)	
VOC Emissions	UL Environment (Greenguard Gold)	Meets Criteria	
ASTM C 1338	Fungi Resistance	No fungal growth	
ASTM D 2856	Closed Cell Content	98%	
ASTM D 6226	Open Cell Content	9.95%	
ASTM C 1029	Standard specification for spray applied rigid cellular polyurethane thermal insulation	Type II Compliant	

FIRE TEST RESULTS		
ASTM E 84	Surface Burning Characteristics, 4" thick Flame Spread Index Smoke Developed	Class I 12 350-400
AC 377 Appendix X	Ignition Barrier – Compliant with 2012, 2015, 2018 & 2021 IBC and IRC, and ICC-ES AC-377 Appendix X, for use in attics and crawl spaces without a prescriptive ignition barrier or intumescent coating.	Pass
NFPA 285	Compliant with 2012, 2015, 2018 & 2021 IBC with brick, metal or aluminum cladding for exterior walls of Type I, II, III and IV buildings of any height. See UES 565 Tables for specific assembly requirements. Contact the Huntsman Building Solutions Engineering Department for assistance with alternate assemblies.	Pass
NFPA 286	Thermal Barrier – Compliant with the 2012, 2015, 2018 & 2021 IBC and IRC, as an interior finish without a 15 minute thermal barrier when coated with DC-315 at 18 mils wet film thickness, 12 mils dry film thickness, or No-Burn Plus ThB at 16 mils wet film thickness, 11 mils dry film thickness.	Pass

RECOMMENDED PROCESSING PARAMETERS		
Initial Primary Heater A-Side (ISO) Setpoint**	92 - 106° F	31 - 41° C
Initial Hose Heat Setpoint**	102 - 115° F	39 - 46° C
Initial Primary Heater B-Side (Resin) Setpoint**	98 - 115° F	37 - 46° C
Initial Processing Setpoint Temperature	1200 - 1400 PSI	8274 - 9653 kPa
Substrate & Ambient Temperature	Summer > 50° F Winter > 15° F	Summer > 10° C Winter > -9° C
Moisture Content of Substrate	≤19%	≤19%
Moisture Content of Concrete	Concrete must be cured, dry, and free of dust and form release agents.	

*Foam application temperatures and pressures can vary widely depending on temperature, humidity, elevation, substrate, equipment and other factors. While processing, the applicator must continuously observe the characteristics of the sprayed foam and adjust processing temperatures and pressures to maintain proper cell structure, adhesion, cohesion and general foam quality. It is the sole responsibility of the applicator to process and apply this product within specification.

**It may be necessary to go outside of the recommended processing parameters or split temps due to ambient temps and material viscosity.

RECYCLED & RENEWABLE CONTENT	
Recyclable Content	19%
Renewable Content	6%

REACTIVITY PROFILE			
Cream Time 0 – 1 seconds	Gel Time 2 seconds	Tack Free Time 3 – 4 seconds	End of Rise 3 – 4 seconds

LIQUID COMPONENT PROPERTIES		
PROPERTY	A-PMDI ISOCYANATE	HEATLOK HFO PRO RESIN
Color	Brown	Blue
Viscosity @ 77°F (25°C)	180 – 220 cps	500 – 800 cps
Specific Gravity	1.24	1.17 – 1.21
Shelf Life of unopened drum properly stored	12 months	6 months
Storage Temperature	50 – 100°F (10 – 38°C)	50 – 70°F (10 – 21°C)
Mixing Ratio (volume)	1:1	1:1

*See SDS for more information.

General Requirements: Equipment must be capable of delivering the proper ratio (1:1 by volume) of polymeric isocyanate (PMDI) and polyol blend at adequate temperatures and spray pressures. Substrate must be at least 5 degrees above dew point, with best processing results when ambient humidity is below 80%. Substrate must also be free of moisture (dew or frost), grease, oil, solvents and other materials that would adversely affect adhesion of the polyurethane foam. Applicators should limit the application of this product to no more than a thickness of 2" (50mm) per pass (after expansion) to avoid fire hazards (including spontaneous combustion) resulting from excessive heat generation. A second 2" (50mm) layer may be applied immediately after the first one has fully risen. Alternatively, a single pass of up to 3" (76mm) may be applied. In either case, if subsequent passes are needed, applicators should wait until the core temperature of the foam has dropped below 100°F to allow any reaction heat to dissipate from the prior applications before attempting to reapply the product.

RECOMMENDED MAXIMUM PASS THICKNESSES		
Maximum Pass	3"	76mm
Dual Pass (x" + x")	2" + 2"	50mm + 50mm

Heatlok HFO Pro must be separated from the interior of the building by an approved thermal barrier or an approved finish material equivalent to a thermal barrier in accordance with applicable codes. Heatlok HFO Pro must be sprayed at a minimum thickness of 1" per pass. This product must not be used when the continuous service temperature of the substrate or foam is below -60°F (-51°C) or above 180°F (82°C). Heatlok HFO Pro should not be used to cover flexible ductwork.

Disclaimer: The information herein is to assist customers in determining whether our products are suitable for their applications. We request that customers inspect and test our products before use and satisfy themselves as to contents and suitability. Nothing herein shall constitute a warranty, expressed or implied, including any warranty of merchantability or fitness, nor is protection from any law or patent inferred. All patent rights are reserved. The foam product is combustible and must be protected in accordance with applicable codes. Protect from direct flame and spark contact, around hot work for example. The exclusive remedy for all proven claims is replacement of our materials.



EXTERIOR WALL SYSTEM COMPONENT
IN ACCORDANCE WITH NFPA 285
SEE BUILDING MATERIALS DIRECTORY
ALSO CLASSIFIED IN ACCORDANCE
WITH ASTM D1929
FILE R39899



HEATLOK® HFO PRO PRODUCT APPLICATION GUIDE

Additional product information can be found on the Huntsman Building Solutions website at www.huntsmanbuildingsolutions.com. Refer to the following documents plus this Product Application Guide to establish processing parameters for varying substrate and climatic conditions:

- Center for Polyurethane Industries, Guidance on Best Practices for the Installation of Spray Polyurethane Foam
- Heatlok HFO Pro Technical Data Sheet
- Heatlok HFO Pro B-side SDS
- A-PMDI SDS

GENERAL PROCESSING GUIDELINE

Heatlok® HFO Pro requires heat from the proportioner to complete the chemical reactions necessary to create foam meeting the specifications on the Technical Data Sheet. Fully functional primary heaters and hose heat are needed to process Heatlok HFO Pro. Please consult the Huntsman Building Solutions Technical Service Department for further assistance.

CHEMICAL CONDITIONING

The chemical drums should be stored and maintained between 50°F (10°C) and 70°F (21°C), before processing at the job site. If the drums are bulged due to excessive heat, do not open the drums. Cool the drums for approximately 24 – 48 hours to allow the reacted blowing agent, Solstice® LBA, to return to a liquid state. Other means of cooling the drums on site may be necessary, contact the Huntsman Building Solutions Technical Service Department for more information.

SUBSTRATE PREPARATION

All surfaces to be sprayed must be free of oil, grease, waxes, rust scale, loose dirt and water. In addition, the substrate must be structurally sound. The moisture content of wood substrates must not exceed 19% before foam is applied. Some metal surfaces may require sandblasting and priming prior to foam spraying to ensure adequate adhesion. Consult a Huntsman Building Solutions Technical Service Representative for additional information on surface preparation. When in doubt about the potential for adhesion to a substrate, build a mock-up and spray the foam under similar conditions to that expected in the field, then test for adhesion and cohesion.

Applying foam insulation to concrete:

- Concrete and masonry must be fully cured and "bone-dry."
- Oils – wash with detergent and allow to dry
- Salt or calcium deposits – wash with detergent and allow to dry
- Muriatic acid can be an effective cleaning agent for preparing concrete substrates prior to spraying foam. Follow the label instructions for dilution and application.

Applying foam insulation to galvanized steel:

- Oils or passivators – clean with solvent, wash with water based cleaner/degreaser, brush blasting may be necessary.
- Do not use hydrocarbon solvents like mineral spirits to clean galvanized metal.
- White rust – wire brushing or scrubbing with a stiff brush or abrasive pad.
- Prime using a DTM (direct to metal) bonding primer suitable for galvanized metal.

Applying foam over previously painted surface:

- Glossy surfaces – sand or abrade surfaces.

Applying foam over bare steel/metal:

- Rust scales – wire brushing or scrubbing with a stiff brush or abrasive pad.
- Corrosion – clean then prime with suitable bonding primer.
- Glossy or very smooth surfaces – sand or abrade surfaces.

Applying foam over stainless steel:

- Oils – wash with mineral spirits and then prime with a suitable primer. Brush blasting, sanding or abrading may be necessary as foam requires a mechanical bond.

Applying foam over aluminum:

- Oils, Hydrated Alumina – clean with solvent, never use a caustic solution, and prime with a high adhesion bonding primer suitable for aluminum.

Applying foam over glass:

- Oils – wash with detergent
- Glossy or very smooth surfaces – sand or abrade surfaces.
- UV degradation – prime glass surface with suitable primer.

Asphalt and Tar:

- Solvents – allow to cure and for solvent to evaporate, prime with suitable primer.

Rigid Polyurethane Foam:

- UV degradation – remove surface of foam with wire brush or wire grinding wheel.

Polypropylene, polyethylene, some silicones and some ceramic surfaces:

- Heatlok HFO Pro may not adhere without a mechanical attachment to these substrates.

APPLICATION PARAMETERS

EQUIPMENT – Follow the spray equipment manufacturer's safe operation guidelines. Every spray unit is slightly different and you will need to adjust your primary heater and hose temperatures accordingly for each polyurethane foam system. Adjust your processing pressures and application technique for an appropriate spray pattern for the substrate and structure.

PROPORTIONER – Use only fixed ratio (one-to-one), volumetric positive displacement pumps connected to a common drive or gear driven systems insuring a one-to-one ratio.

RATIO ASSURANCE TYPE SOFTWARES – Huntsman Building Solutions concurs with allowing a setting of a maximum ratio variance of 5%. Any deviance from that should be addressed immediately before continuing the installation. It should be noted that such tools and information are merely aids to spray foam contractors. *

TRANSFER PUMPS – Use 2:1 or 1:1 double acting transfer pumps assuring equal pressure is delivered from both sides to the proportioner. Diaphragm pumps, wall mounted or drum mounted pumps should not be used to process 2 lb foams containing the blowing agent Solstice LBA. Contact the Huntsman Building Solutions Technical Service Department for recommendations.

PRIMARY HEATERS – The primary heaters should be resistance controlled, direct contact heating rods, either submersible, mass block and tube style or combination of direct heating contact rods and mass block (hybrid heater). The primary heaters should be controlled through independent controllers, separated from the hose heat to ensure an accurate setpoint temperature. Heatlok may not be consistently sprayed in conformance with the written specification if the combination of the proportioner's pumping capacity, the primary heat capability and spray gun discharge rate (mixing chamber size) is out of balance. Contact the Huntsman Building Solutions Technical Service Department for further guidance.

HEATED HOSE – Huntsman Building Solutions recommends the use of heated spray hoses rated at ≥ 2000 psi. Use moisture resistant hoses specifically designed for isocyanate. The heated spray hose should be able to maintain temperatures up to 190°F (88°C) and should be heated using an electrical element with an independent temperature sensor. The heated hose should also be adjusted and monitored separately from the A and B primary heaters, and should be capable of maintaining the temperature from the A and B primary heaters all the way to the spray gun.

FLUSHING/CHANGING FROM ANOTHER CHEMICAL TO HEATLOK HFO PRO

Follow the published flushing procedure on the Huntsman Building Solutions website. Never flush water through the A-side (iso side). Failure to properly flush will result in off-spec foam and does not comply with the ICC Evaluation Service Report and does not qualify for the Huntsman Building Solutions Limited Lifetime Warranty.

FOAM APPLICATION

In preparation for spraying, an off-target test spray should be performed to verify the processing pressure, primary heater and hose temperature settings. The "initial setpoint temperatures" listed below and on the Technical Data Sheet are suggested general starting parameters; it's important to observe the foam and the reaction time of the reacting mass and make additional adjustments throughout the day as needed to maintain proper cell structure, adhesion, cohesion and general foam quality.

RECOMMENDED PROCESSING CONDITIONS*		
Initial Primary Heater Setpoint Temperature	105 – 115°F	41 – 46°C
Initial Hose Heat Setpoint Temperature	105 – 115°F	41 – 46°C
Initial Processing Setpoint Pressure	1200 – 1400 psi	8274 – 9653 kPa
Substrate & Ambient Temperature	Summer > 50°F Winter > 15°F	Summer > 10°C Winter > -9°C
Moisture Content of Substrate	$\leq 19\%$	$\leq 19\%$
Moisture Content of Concrete	Concrete must be cured, dry and free of dust and form release agents.	

*Foam application temperatures and pressures can vary widely depending on temperature, humidity, elevation, substrate, equipment and other factors. While processing, the applicator must continuously observe the characteristics of the sprayed foam and adjust processing temperatures and pressures to maintain proper cell structure, adhesion, cohesion and general foam quality. It is the sole responsibility of the applicator to process and apply this product within specification.

One proven method of applying Heatlok HFO Pro is to spray perpendicular (90 degree angle) to the substrate, holding the gun 18 – 24" away from the substrate. This technique also helps minimize over spray. Heatlok HFO Pro should be applied by spraying vertically or horizontally to the substrate while overlapping the passes 60 – 80%. Apply by spraying into the gelling material (wet line) as it is rising. If the processing parameters are set too high, the pattern may be uncontrollable, the mixing chamber may clog often, the wet line will not be as pronounced and the surface characteristics will be rough. When the parameters are too low the foam may spray in a direct stream and remain un-reacted for several seconds.

Always spray perpendicular to the surface in 1" to 3" lifts. Applicators should limit the application of this product to no more than a thickness of 2" (50mm) per pass (after expansion) to avoid fire hazards (including spontaneous combustion) resulting from excessive heat generation. A second 2" (50mm) layer may be applied immediately after the first one has fully risen. If subsequent passes are needed, applicators should wait until the core temperature of the foam has dropped below 100°F to allow any reaction heat to dissipate from the prior applications before attempting to reapply the product. It is recommended to use a 0 – 220°F pocket sized, self-penetrating thermometer to ensure that the foam has cooled before additional layers can be applied. Spraying sections too thick, too fast may result in charring of the foam, or in extreme conditions a fire may result. Thin foam layers often result in poor physical properties, reduced coverage and poor chemical reaction due to low exothermic heat generated from the chemical reaction, which is needed to create proper closed cell formation. When multiple layers are necessary to achieve the proper R-value, cross-hatching should be done. This technique aids in proper cohesion of passes.

The temperature of the substrate has a major effect on the foam density and adhesion. Certain compromises are necessary to spray in cold weather. The "COLD WEATHER PROCESSING" section offers more information on this topic. If in doubt about the substrate or the ambient conditions, a trial application should be done to check foam quality and spray performance. Water on the substrate from rain, fog, condensation, etc. will react chemically with the isocyanate, adversely affecting the physical properties, performance and adhesion of the foam. Heatlok should never be applied when the relative humidity is above 80%, as high relative humidity can adversely affect the physical properties of the foam.

EXTERIOR FOAM APPLICATION

Climatic conditions are an important factor that should be considered when preparing to apply foam to the exterior of a structure. Ambient and substrate temperatures should be monitored. Foam should only be applied when ambient and substrate temperatures are inside the range for the foam system being used. Foam should only be applied to substrates with less than 19% moisture content. It is best to apply foam when the humidity is less than 80% and the wind is less than 10 mph to maintain proper adhesion. Pay close attention to the temperature of the substrate when applying foam to the exterior of a structure.

Use windscreens downwind, the foam can travel long distances because the particles may separate when airborne. Windscreens can also be configured around scaffolding and man-lifts. It may also be necessary to enclose and preheat the area to the acceptable temperature range for the foam system being used. In preparation for spraying, a test spray should be performed to ensure that the proper processing temperatures and pressures are set. The specified settings per the TDS are general starting parameters, it is important to observe the foam and the reaction time of the reacting mass and make additional adjustments as needed.

Always spray perpendicular to the surface in 1" to 3" lifts. Applicators should limit the application of this product to no more than a thickness of 2" (50mm) per pass (after expansion) to avoid fire hazards (including spontaneous combustion) resulting from excessive heat generation. A second 2" (50mm) layer may be applied immediately after the first one has fully risen. If subsequent passes are needed, applicators should wait until the core temperature of the foam has dropped below 100°F to allow any reaction heat to dissipate from the prior applications before attempting to reapply the product. It is recommended to use a 0 – 220°F pocket sized, self-penetrating thermometer to ensure that the foam has cooled before additional layers can be applied. Spraying sections too thick, too fast may result in charring of the foam, or in extreme conditions a fire may result. Thin foam layers often result in poor physical properties, reduced coverage and poor chemical reaction due to low exothermic heat generated from the chemical reaction, which is needed to create proper closed cell formation. When multiple layers are necessary to achieve the proper R-value, cross-hatching should be done. This technique aids in proper cohesion of passes. Successive passes should overlap 60 – 80% to ensure a smooth surface free of ridges. The thickness of the insulation should be measured with a depth gauge. A final pass should be applied to cover the holes made by the depth gauge and thermometer.

RECOMMENDED MAXIMUM PASS THICKNESS

Maximum Pas	3"	76mm
Dual Pass (x" + x")	2" x 2"	50mm + 50mm

COLD STORAGE APPLICATIONS

Cold storage facilities require vapor barriers. Vapor barriers are typically applied to the warm side of the insulation system. Heatlok HFO Pro applied at a thickness of or greater than 1.25" is classed as a vapor barrier. Use 1" (25mm) lift passes, thicker passes in deep freezers can lead to severe cracking. Freezers require 2 lb foam, using lower density foam or an over catalyzed foam can also lead to severe cracking. Proper surface preparation may be necessary prior to the application of Heatlok in cold storage applications. Contact the Huntsman Building Solutions Technical Service Department for more information about cold storage applications.

Materials used to construct refrigerated rooms are affected by temperature changes, like all common building materials. Gradual lowering of the temperature is designed to eliminate problems stemming from these temperature changes while at the same time withdrawing construction moisture, and testing the vapor barrier and mechanical system.

COLD STORAGE FACILITY COOL DOWN SCHEDULE

TIME PERIOD	MAX. TEMP. REDUCTION	MIN. ROOM TEMP.
First 24 hours	—	75°F (24°C)
Second 24 hours	15°F (-9°C)	60°F (16°C)
Third 24 hours	15°F (-9°C)	45°F (7°C)
Fourth 24 hours	10°F (-12°C)	35°F (2°C)
Until room is dry (watch moisture on coils as an indicator)	0°F (-18°C)	35°F (2°C)

TEMPERATURE REDUCTION AFTER ATTAINING DRY STATE

TIME PERIOD	MAX. TEMP. REDUCTION	MIN. ROOM TEMP.
First 24 hours	5°F (-15°C)	30°F (-1°C)
Second 24 hours	10°F (-12°C)	20°F (-7°C)
Third 24 hours	10°F (-12°C)	10°F (-12°C)
Fourth 24 hours	10°F (-12°C)	0°F (-18°C)
Fifth 24 hours	10°F (-12°C)	-10°F (-23°C)

HOW TO AVOID OVER SPRAY

Over spray with closed cell foams occurs for a variety of reasons such as spraying the product too cool, applying the product to a substrate that is too cold, not spraying perpendicular to the surface, and high wind conditions. Flash coating to warm the surface is not a recommended practice and may create unwanted over spray. Flash coats are very thin and may not have enough exothermic reaction present to properly cure. Excessive over spray may lead to blisters or delaminating of additional passes of foam or coating. Over spray can travel long distances and may adhere to objects left unprotected such as windows, buildings and automobiles. Protect anything that should not get foamed.

LIMITATIONS OF USE

Heatlok HFO Pro is a combustible material with a maximum continuous service temperature of 180°F (82°C). Heatlok HFO Pro should not be used in direct contact with chimneys, flues, steam pipes, recessed lighting or heat emitting devices. Consult the listing or label of such materials for clearance to combustibles. A minimum clearance of 3" (76mm) should be maintained when applying around recessed lighting, and it's important to avoid spraying inside electric outlets or junction boxes. Properly prep and secure any material or surface that should not get insulated. If in doubt about the substrate temperature or surface conditions, a trial application should be conducted to check foam quality and spray performance. Water on the surface from rain, fog, condensation, etc. will react chemically with the isocyanate, adversely affecting the foam and physical properties, particularly adhesion.

COLD WEATHER PROCESSING

Heatlok HFO Pro can be used down to 15°F (-9°C).

Low temperatures affect the foaming process in two ways.

1. Chemical reactions can be slowed due to reduced exothermic energy within the expanding mass, which could lead to poor cell structure, dripping and voids from slow plastic formation
2. This reduced temperature often leads to reduced yield.

The temperature and type of substrate has a greater influence on the quality of the foam than the temperature of the air because the rate of heat transfer from liquid to air is much slower than the rate from liquid to substrate. If the substrate temperature is too low, or it is a highly conductive material such as metal or concrete, the heat produced by the chemical reaction may be drawn into the substrate so rapidly that plastic formation and cell generation becomes very slow, thus reducing yield. It is not a good practice to use the heated chemicals to warm the surface (flash coat). Instead, if the substrate to be sprayed is too cold to produce proper foam, the substrate should be heated using an indirect-fired heater or the foam should be sprayed on a warmer substrate on a warmer day. No open flame or direct heating is permitted during the spraying process.

THERMAL AND UV PROTECTION

Like all foam plastics, Heatlok HFO Pro must be separated from the living space by a 15 minute thermal barrier in accordance with applicable codes. This product must not be used when the continuous service temperature of the substrate or foam is below -60°F (-51°C) or above 180°F (82°C). Heatlok HFO Pro must be protected from direct exposure to sunlight; incidental exposure during construction may cause surface discoloration but will not degrade the performance of the foam.

VENTILATION

Ventilate during spray foam application and for a minimum of 24 hours following the application or until no objectionable odor remains. If not adequately ventilated during and shortly after application, the odors can be absorbed in adjacent materials such as fibrous insulation, wood framing and household or stored items. Sheet plastic should be placed over any absorbent material that cannot be removed during the spray and ventilation operation.

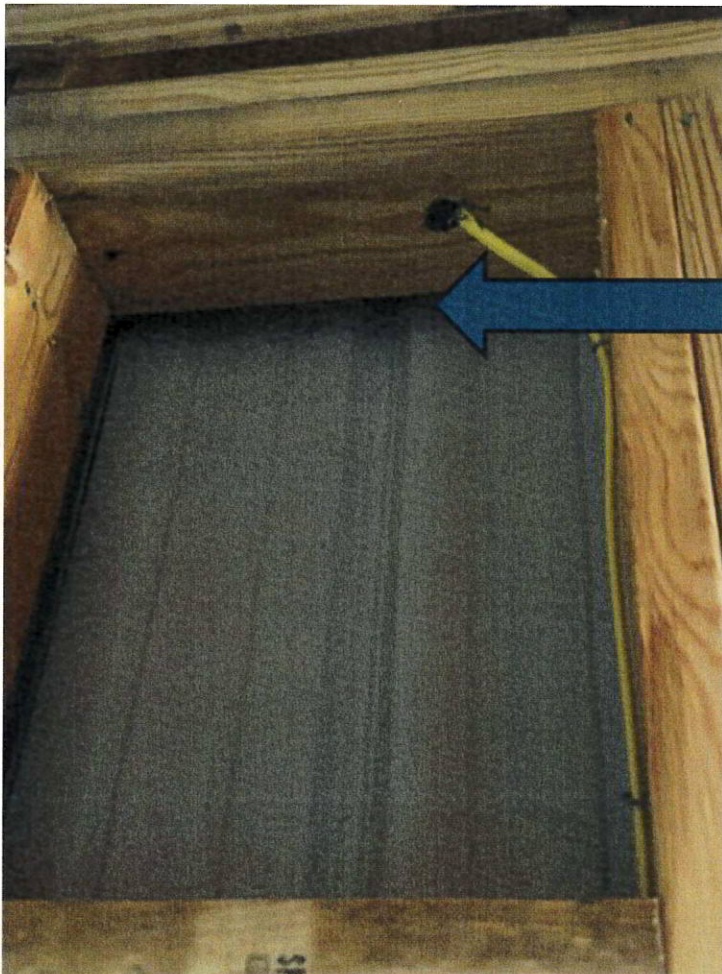
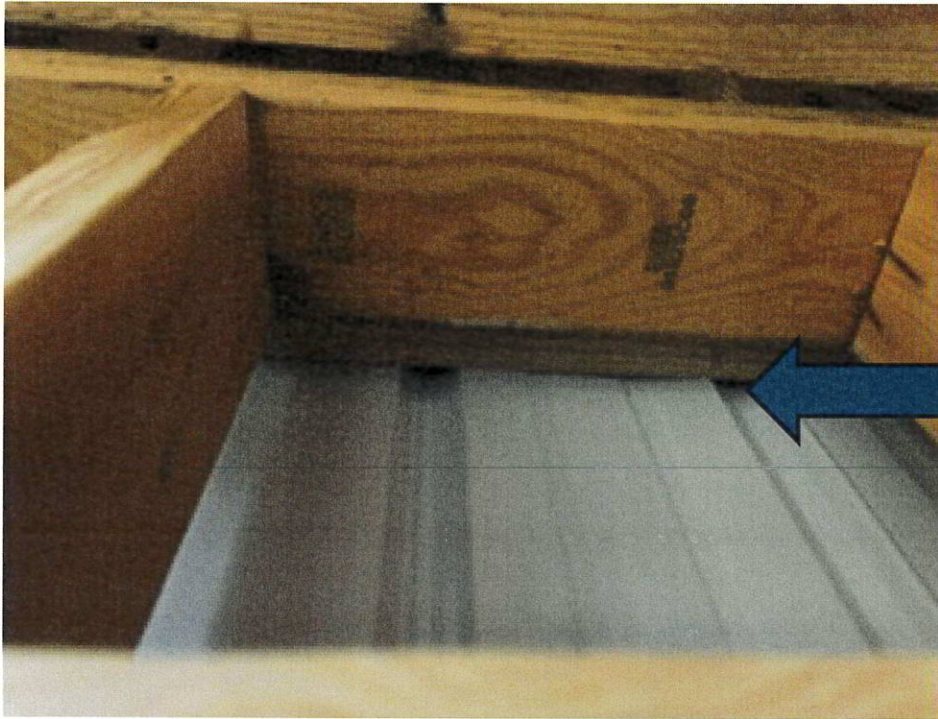
CHEMICAL STORAGE

Heatlok HFO Pro B-side resin is packaged in totes or in closed-head metal drums. A-PMDI is packaged in totes or in closed-head metal drums. Store the B-side resin at temperatures between 50°F (10°C) and 70°F (21°C). Store the A-side isocyanate at temperatures between 50°F (10°C) and 100°F (38°C). Keep away from direct sunlight. Remove the transfer pump and tightly close the bungs of the A-PMDI and B-side drum after use. Heatlok HFO Pro B-side resin has a 6 month shelf life when stored within the acceptable storage temperatures and the drum is in its original condition with the bungs having never been removed. See Heatlok HFO Pro B-side SDS for additional product information.

FOR MORE INFORMATION

Visit www.huntsmanbuildingsolutions.com or call 817-640-4900 for more information on health, safety and environmental protection with respect to polyurethane chemicals.

Disclaimer: The information herein is to assist customers in determining whether our products are suitable for their applications. We request that customers inspect and test our products before use and satisfy themselves as to contents and suitability. Nothing herein shall constitute a warranty, expressed or implied, including any warranty of merchantability or fitness, nor is protection from any law or patent inferred. All patent rights are reserved. The foam product is combustible and must be protected in accordance with applicable codes. Protect from direct flame and spark contact, around hot work for example. The exclusive remedy for all proven claims is replacement of our materials.



HUNTSMAN

BUILDING SOLUTIONS

March 3, 2026
KC Construction Company, LLC
188 Toronto Trail
Clyde, NC
28721
Attn: Mr. Kyle Chandler-Proprietor

Re: Heatlok® HFO Pro and Foam-Lok FL500- Wall Assembly at 153 Foxtrail Trl., Asheville, NC
28806- Fire Blocking Requirements

Dear Mr. Chandler,

This letter serves to confirm that you have described the application Heatlok® HFO Pro spray applied polyurethane foam insulation directly to the corrugated metal siding at the floor/ceiling intersections followed by a full cavity fill application of Foam-Lok FL500 spray applied polyurethane foam insulation.

The 2024 North Carolina State Residential Code, Section R302.11: Fireblocking, states: ***"In combustible construction, fireblocking shall be provided to cut off both vertical and horizontal concealed draft openings and to form an effective fire barrier between stories, and between the top story and the roof space."***

The 2024 North Carolina State Residential Code, Section 202, defines Fireblocking as follows, *"Building materials or materials approved for use as fireblocking, installed to resist the free passage of flame to other areas of the building through concealed spaces."*

The primary purpose of fire blocking is to prevent the vertical movement of flames, smoke, and gases within a building. Fire blocking achieves this by sealing off **gaps and hidden spaces**, which helps contain the fire to its original area. This containment provides occupants with more time to evacuate and allows firefighters to have more time to respond.

Moreover, fire blocking restricts the flow of oxygen, which is crucial for a fire to grow and spread. By limiting the airflow, fire blocking effectively slows down the combustion process, thereby aiding in the suppression of the fire.

The application described above includes a spray foam air impermeable insulation filled wall cavity inclusive of an air impermeable spray foam applied at the floor/ceiling intersections with the exterior wall. With the elimination of airspaces, draft openings, gaps and hidden spaces resulting from this monolithically occupied wall assembly with spray polyurethane foam insulation renders an assembly containing no potential for vertical or horizontal concealed draft openings, the functionality surrounding the requirement for fireblocking, and as such Section R302.11 of the 2024 North Carolina State Residential Code is not applicable to this specific application.

With warm regards,

Paul Warren
Building Science and Engineering Manager

HUNTSMAN
BUILDING SOLUTIONS

Mobile: 520-610-6216 | Email: paul_warren@huntsman.com



Permits & Inspections

Jason Rogers
Director

June 29, 2026

Kevin Evan Chandler
188 Toronto Trail
Clyde, NC 28721

Re: Review of Alternative Material, Design or Method in accordance with section 105 of the NC Administrative Code for 153 Foxtail Trail for compliance with the Water Resistive Barrier requirements of 2018 NC Residential Building Code section 703.

Dear Mr. Chandler:

On June 23, 2026, your team met with Jason Rogers, Director, Permits and Inspections and Tim Love, Assistant County Manager. In this meeting it was agreed that the Inspection Department Team would evaluate this alternative method again as requested for compliance.

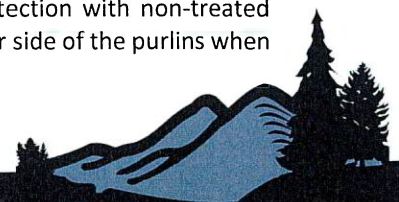
After review, we have confirmed that the building does not have a water resistive barrier prescriptively in accordance with section 703 of the North Carolina Residential Building Code.

- We have reviewed your supporting evidence, Heatlok® HFO PRO Spray-Applied Polyurethane Foam Plastic Insulation. IAMPO Uniform Evaluations Services ("UES") Evaluation Report Number 565 (exhibit 1), 1.0 Recognition states: "The physical properties, water vapor resistance, air permeance, thermal resistance, and attic and crawl space installations, and exterior walls of Types I-IV construction were evaluated to comply with the intent of the following codes and regulations". The 2015 Residential Code is listed. This is the base code for the 2018 NC Residential Building Code.
- We have also sourced ICC-ES Evaluation Report ESR-4073 (exhibit 2)- This evaluation states" Heatlok HFO closed cell spray foam is a spray-applied polyurethane foam plastic insulation used as a nonstructural thermal insulating material in all types of construction under the IBC and in dwellings under the IRC".
- We have also reviewed the Technical Data Sheet for Heatlok HFO PRO (exhibit 3) for reference standard evaluations.
- We have also provided photographs of the situation as they exist on site (exhibit 4).

The Heatlok HFO is not supported in the documentation for specific use on this project for a water resistive barrier.

- Exhibit 1- does not have any supporting drawing showing this product used in this application. There is no supporting evidence this product can create an effective water resistive barrier.
- Exhibit 2- Has supporting evidence that this product can be used as a water resistive barrier. This application is continuous on the exterior of the building pages 16-22 of the report. This application would be interior applied and is not addressed in this report.
- Exhibit 3- The NC Residential code section 703 has three ASTM approval sections ASTM E331, ASTM E330 and ASTM D226. These approvals are not listed for this product.

Further, the spray foam application cannot create an effective water resistive barrier when applied interior in this type of construction. The wood purlins would not have the water resistive barrier protection with non-treated lumber from excessive water intrusion. The water barrier cannot be applied on the exterior side of the purlins when the siding is in direct contact with them. See exhibit 4 for photographs.



In conclusion, Heatlok® is not acceptable alternative material, design or method. It cannot be applied to create an effective water resistive barrier in the application with the wood purlins being in contact with the metal siding and no barrier between. Heatlok also does not have supporting testing for this application.

This was also discussed with the Chief Code Consultant with the NC Department of Insurance. During this conversation it was pointed out that the water barrier was ineffective when installed over the interior of the purlins not protecting these components from water intrusion.

This decision can be appealed to the NC Department of Insurance in accordance with section 203.2.2 of the 2018 NC Administrative Code and Policies.

203.2.2 Appeals

Any person may appeal in writing an order or determination of a code enforcement official pertaining to the code or any state building law. The appeal shall be addressed to the Chief Engineer of the Department of Insurance by filing written notice within 10 days after the order, decision or determination. The appeal shall contain the types and size of the building in question, the location of the building and shall reference the code section(s) in question. The decision shall be in writing and shall set forth the facts found. The decision rendered shall be based on the technical provisions of the code, public health and safety and shall be construed liberally to those ends. A decision shall be binding on all parties unless an appeal is submitted to the Building Code Council as specified in section 201.9.2. A copy of the appeal and written decision shall be furnished to both parties.

Sincerely,

Jason R. Rogers
Director, Permits and Inspections
35 Woodfin Street, Asheville, NC 28801
828-250-5384
jason.rogers@buncombenc.gov



EVALUATION REPORT

Number: **565**

Originally Issued: 03/08/2018

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Valid Through: 03/31/2026

HUNTSMAN BUILDING SOLUTIONS, INC.
3315 East Division Street
Arlington, Texas 76011
Phone: (817) 640-4900
www.huntsmanbuilds.com

HEATLOK® HFO PRO SPRAY-APPLIED POLYURETHANE FOAM PLASTIC INSULATION

CSI Section:

07 21 00 Thermal Insulation

1.0 RECOGNITION

Heatlok® HFO Pro spray-applied polyurethane foam plastic insulation has been evaluated for use as spray foam insulation complying with IBC Section 2603; IRC Section R316; and 2021, 2018, 2015, and 2012 IECC Sections C303, C402, R303, and R402; and 2009 IECC Sections 303, 402, and 502. The physical properties, water vapor resistance, air permeance, thermal resistance, surface burning characteristics, fire-resistance, and attic and crawl space installations, and exterior walls of Types I-IV construction were evaluated to comply with the intent of the following codes and regulations:

- 2021, 2018, 2015, 2012, and 2009 International Building Code® (IBC)
- 2021, 2018, 2015, 2012, and 2009 International Residential Code® (IRC)
- 2021, 2018, 2015, 2012, and 2009 International Energy Conservation Code® (IECC)

2.0 LIMITATIONS

Use of the Heatlok® HFO Pro spray-applied polyurethane foam plastic insulation recognized in this report is subject to the following limitations:

2.1 The insulation and coating products shall be installed in accordance with the manufacturer's published installation instructions, this evaluation report, and the applicable code. If there are any conflicts between the manufacturer's published installation instructions and this report, the more restrictive shall govern.

2.2 Except as permitted by the applicable building code, the insulation shall be separated from the interior of the building by a code-complying thermal barrier or shall be installed as an alternative thermal barrier assembly in accordance with Section 4.5.1 of this report

2.3 The insulation shall not exceed the nominal density and thickness for the installation conditions described in this report.

2.4 During application, the insulation shall be protected from exposure to weather.

2.5 The insulation shall be installed by professional spray polyurethane foam installers authorized by Huntsman Building Solutions, Inc.

2.6 Use of the insulation in areas of "very heavy" termite infestation probability shall be in accordance with 2021, 2018, 2015, and 2009 IBC Section 2603.8, and 2012 IBC Section 2603.9, or IRC Section R318.4, as applicable.

2.7 Heatlok® HFO PRO insulation qualifies as a vapor retarder when installed as required in Section 4.7 of this report.

2.8 Labeling and jobsite certification of the insulations and coatings shall comply with the following code sections as applicable:

- 2021, 2018, 2015, or 2012 IBC Section 2603.2
- 2021, 2018, 2015, or 2012 IRC Section R316.2
- 2021, 2018, and 2015 IRC Section N1101.10.1.1
- 2012 IRC Section N1101.12.1.1
- 2009 IRC Section N1101.4
- 2021, 2018, 2015, or 2012 IECC Sections C303.1.1.1 or R303.1.1.1
- 2009 IECC Section 303.1.1.1

2.9 The insulation shall be produced by Huntsman Building Solutions, Inc. in Arlington, TX.

3.0 PRODUCT USE

Heatlok® HFO Pro spray-applied polyurethane foam plastic insulation complies with IBC Section 2603; IRC Section R316; and 2021, 2018, 2015, and 2012 IECC Sections C303, C402, R303, and R402; and 2009 IECC Sections 303, 402, and 502. When installed in accordance with Section 4.0 of this report, the foam plastic insulation is for use in wall cavities, floor assemblies or ceiling assemblies, exterior side of vertical foundations, or the underside of slabs. It may be used in attics and crawl spaces when installed with Section 4.5.1. Heatlok® HFO Pro insulation is used in Types I, II, III, IV, and V construction under the IBC and in one- and two-family dwellings under the IRC.

4.0 PRODUCT DESCRIPTION

4.1 Properties: Heatlok® HFO Pro is a medium density, closed cell, spray-applied polyurethane foam plastic insulation in accordance with Table 1 of AC377. The insulation has a nominal in-place density of 2.0 lb/ft³ (32 kg/m³). The two-component spray foam plastic is produced in the field by combining a polymeric isocyanate

The product described in this Uniform Evaluation Service (UES) Report has been evaluated as an alternative material, design or method of construction in order to satisfy and comply with the intent of the provision of the code, as noted in this report, and for at least equivalence to that prescribed in the code in quality, strength, effectiveness, fire resistance, durability and safety, as applicable, in accordance with IBC Section 104.11. This document shall only be reproduced in its entirety.

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(A component) and the Heatlok® HFO Pro resin (B component). The liquid components shall be stored in 55-gallon (208 L) drums at temperatures between 50°F and 100°F (10°C and 38°C) for the polymeric isocyanate and 59°F and 77°F (15°C and 25°C) for the Heatlok® HFO Pro resin. When Component A and Component B are stored in factory-sealed containers at the recommended temperatures, the maximum shelf life is twelve months for the polymeric isocyanate and six months for the Heatlok® HFO Pro resin.

4.2 Thermal Resistance (R-Values): Heatlok® HFO Pro spray-applied polyurethane foam plastic insulation has a thermal resistance (R-Value) at a mean temperature of 75°F (24°C) as shown in Table 1 of this report.

TABLE 1 Thermal Resistance (R-Values) ¹	
Thickness (inch)	Heatlok® HFO Pro R-Value (°F·ft ² ·h/Btu)
1	7.4
1.5	11
2	14
3	20
3.5	23
4	26
5	33
5.5	36
6	40
7	46
7.5	49
8	53
9	59
10	66
11	72
11.5	76
12	79

For SI: 1 inch = 25.4 mm, 1°F·ft²·h/Btu = 0.176 110 K·m²/W.

¹R-Values are calculated based on tested K values at 1-inch and 4-inch thicknesses.

4.3 Surface Burning Characteristics: At a maximum thickness of 4 inches (102 mm) and a nominal density of 2.0 lb/ft³ (32 kg/m³), the Heatlok® HFO Pro insulation has a flame spread index of 25 or less and smoke-developed index of 450 or less when tested in accordance with ASTM E84. Greater thicknesses, depending on the end use, are recognized when installed in accordance with this report.

4.4 Fire-Protective Coatings and Coverings: Fire protective coatings, for use as alternative thermal barrier assemblies, shall be in accordance with Table 2 of this report, as applicable, and installed in accordance with Section 4.5 of this report.

4.5 Installations: Heatlok® HFO Pro spray-applied polyurethane foam plastic insulation shall comply with one of the following requirements:

- 2021, 2018, 2015, and 2012 IECC Section C402.1
- 2021, 2018, 2015, and 2012 IECC Section R402.1
- 2009 IECC Sections 402.1 or 502.1, as applicable

The manufacturer's published installation instructions for Heatlok® HFO Pro insulation and this report shall be available on the jobsite during installation. Where conflicts occur, the most restrictive governs.

Heatlok® HFO Pro insulation shall be spray-applied on the jobsite using equipment specified in the manufacturer's published installation instructions. The maximum in-service temperature for all areas shall not exceed the maximum temperature stated in the manufacturer's published installation instructions. The insulation shall be sprayed onto a clean, dry substrate that has been prepared in accordance with the manufacturer's installation instructions. The insulation shall not be used in electrical outlets or junction boxes or where the insulation will be in direct, continuous contact with water.

4.5.1 Thermal Barrier

4.5.1.1 Application with an Approved Thermal Barrier:

Except as provided for in Section 4.5.1.2 of this report, Heatlok® HFO Pro spray-applied polyurethane foam plastic insulation shall be separated from the interior by a thermal barrier in accordance with IBC Section 2603.4 or IRC Section R316, as applicable. When the insulation is separated from the interior by a prescriptive thermal barrier in accordance with IBC Section 2603.4 or IRC Section R316, the insulation thickness shall not be limited.

4.5.1.2 Alternative Thermal Barrier Assemblies: Heatlok®

HFO Pro spray-applied polyurethane foam plastic insulation may be installed without a thermal barrier as defined in Section 4.5.1.1 of this report when installed in accordance with Table 2 of this report and as referenced in [IAPMO UES ER-499](#) or additional report by an approved evaluation entity to the requirements of AC456.

4.5.2 Installation in Attics or Crawl Spaces: Heatlok® HFO

Pro spray-applied polyurethane foam plastic insulation may be installed in attics or crawl spaces when installed in accordance with this section (Section 4.5).

When installed in attics or crawl spaces where entry is made only for the service of utilities, Heatlok® HFO Pro insulation may be installed in accordance with this section. Heatlok® HFO Pro insulation need not be surfaced with a thermal barrier, however, such attic and crawl space areas shall be separated from the interior of the building by a thermal barrier in accordance with Section 4.5.2 of this report.

4.5.2.1 Installation Using a Prescriptive Ignition Barrier:

When installed within attics or crawl spaces where entry is made only for the service of utilities, Heatlok® HFO Pro spray-applied polyurethane foam plastic insulation, at a maximum thickness of 7.5 inches (191 mm) on walls and



other vertical surfaces and 11.5 inches (292 mm) on ceilings and other overhead surfaces, shall be covered with a prescriptive ignition barrier in accordance with IBC Section 2603.4.1.6 or IRC Sections R316.5.3 and R316.5.4, as applicable.

Exception: The prescriptive ignition barrier may be omitted when installed in accordance with Section 4.5.2.2 of this report.

4.5.2.2 Installation Using an Alternative Ignition Barrier Assembly: Heatlok® HFO Pro spray-applied polyurethane foam plastic insulation may be installed in attics and crawl spaces using an alternative ignition barrier assembly provided:

- a. Entry is only to service utilities in the attic or crawl space and no storage is permitted.
- b. Attic or crawl space areas cannot be interconnected.
- c. Air from the attic or crawl space cannot be circulated to other parts of the building.
- d. Attic ventilation is provided as required by 2021 and 2018 IBC Section 1202.2, 2015 and 2012 IBC Section 1203.2, or IRC Section R806 except where air-impermeable insulation is permitted in unvented attics and shall comply with the following code sections as applicable:

For Unvented Attics:

- 2021 and 2018 IBC Section 1202.3
- 2015 IBC Section 1203.3
- 2021, 2018, 2015, 2012, and 2009 IRC Section R806.5

Crawl space ventilation is provided as required by the following code sections as applicable:

- 2021 and 2018 IBC Section 1202.4
- 2015 IBC Section 1203.4
- 2012 and 2009 IBC Section 1203.3
- 2018, 2015, 2012, and 2009 IRC Section R408.1

- e. The foam plastic insulation is limited to the maximum thickness and density tested as shown in Section 4.5.2.2.1 of this report.
- f. In accordance with IMC (International Mechanical Code®) Section 701, combustion air is provided.

4.5.2.2.1 Alternative Ignition Barrier Assembly: Heatlok® HFO Pro spray-applied polyurethane foam plastic insulation may be installed without a prescriptive ignition barrier on walls, floors, ceilings, and other vertical and horizontal surfaces as defined in Section 4.5.2.1 of this report when limited to a maximum thickness of 7.5 inches (191 mm) on walls and other vertical surfaces and 11.5 inches (292 mm) on ceilings and other overhead surfaces.

4.6 Air Permeability: When tested in accordance with ASTM E2178 at a minimum thickness of 1 inch (25.4 mm), Heatlok® HFO Pro spray foam insulation is classified as air-

impermeable insulation in accordance with Section 1202.3 of the 2021 and 2018 IBC, Section 1203.3 of the 2015 IBC, and Section R806.5 of the 2021, 2018, 2015, and 2012 IRC or Section R806.4 of the 2009 IRC, as applicable.

4.7 Vapor Permeance: Heatlok® HFO Pro spray-applied polyurethane foam plastic insulation, when tested in accordance with the ASTM E96 desiccant method (Procedure A), has a permeance of less than 1.0 perms ($57.4 \times 10^9 \text{ g/Pa}\cdot\text{s}\cdot\text{m}$), at a minimum thickness of 1 inch (25 mm) and qualifies as a Class II vapor retarder in accordance with IBC Section 202 and IRC Section R202.

4.8 One-hour Fire-resistance Rated Assembly: The following load-bearing assembly based on testing to ASTM E119 provides a one-hour fire-resistance rating.

Framing: 3⁵/₈-inch (92 mm) 20-gauge steel studs with a maximum height of 10 feet (3 m) spaced at 16 inches (406 mm) on center inserted in a 20-gauge top and bottom steel track with lateral bracing at mid-wall height.

Exterior Surface: Two layers of 5/₈-inch-thick (15.9 mm) glass mat gypsum substrate complying with ASTM C1177. The base layer is installed with the long edge parallel to the studs with #6 by 1¹/₂-inch-long (38 mm) drywall screws spaced at 8 inches (203 mm) on center around the perimeter and 12 inches (305 mm) on center in the field. The face layer is installed with the long edge parallel to the studs with the base layer and face layer joints staggered by one stud space. The face wall is secured with #6 by 1⁷/₈-inch-long (48 mm) drywall screws spaced at 8 inches (203 mm) on center around the perimeter and 12 inches (305 mm) on center in the field.

Insulation: 3⁵/₈-inch-thick (92 mm) layer of Heatlok® HFO Pro spray-applied polyurethane foam plastic insulation applied in the cavities to the exterior gypsum completely filling the stud cavities.

Interior Cladding: Two layers of 5/₈-inch-thick (15.9 mm) Type X gypsum board complying with ASTM C1396. The base layer shall be installed with the long edge parallel to the studs with #6 by 1¹/₂-inch-long (38 mm) drywall screws spaced at 8 inches (203 mm) on center around the perimeter and 12 inches (305 mm) on center in the field. The face layer shall be installed with the long edge parallel to the studs with the base layer and face layer joints staggered by one stud space. The face wall is secured with #6 by 1⁷/₈-inch-long (48 mm) drywall screws spaced at 8 inches (203 mm) on center around the perimeter and 12 inches (305 mm) on center in the field.

4.9 Exterior Walls of Buildings of Type I, II, III, or IV Construction: When Heatlok® HFO Pro spray-applied polyurethane foam plastic insulation is used in exterior walls of buildings of Type I, II, III, or IV construction of any height, the insulation shall comply with IBC Section 2603.5 and this section. Heatlok HFO Pro insulation shall be installed at a maximum thickness of 3⁵/₈ inches (92 mm).



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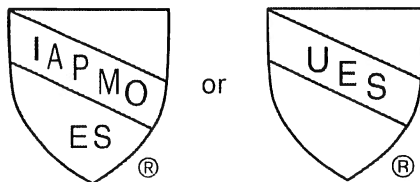
4.9.1 Complying Exterior Wall Assemblies: Wall assemblies that comply with Section 2603.5.5 of the IBC and this report that may be used in exterior walls of buildings of Type I, II, III, or IV construction of any height are described in Tables 3 and 4 of this report.

5.0 IDENTIFICATION

The spray foam insulation is identified with the following:

- Manufacturer's name (Huntsman Building Solutions), Inc.
- manufacturer's address and telephone number,
- the product trade name (Heatlok® HFO Pro)
- use instructions
- density, flame-spread and smoke-development indices
- date of manufacture or batch/run number
- thermal resistance values
- the evaluation report number (ER-565)
- the name or logo of the inspection agency

Either IAPMO UES Mark of Conformity may also be used as shown below:



IAPMO UES ER-565

6.0 SUBSTANTIATING DATA

6.1 Data in accordance with the ICC-ES Acceptance Criteria for Spray-applied Foam Plastic Insulation, AC377, dated April 2020 (editorially revised July 2020) including Appendix X.

6.2 Flammability Testing to NFPA 286, Standard Methods of Fire Tests for Evaluation of Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.

6.3 Report of air permeance testing in accordance with ASTM E2178.

6.4 Report of water vapor transmission performance in accordance with ASTM E96.

6.5 Fire-resistance testing to ASTM E119.

6.6 Report of fire-propagation characteristics tests in accordance with NFPA 285.

6.7 Third party engineering analysis for extension of NFPA 285 results.

6.8 IAPMO/ANSI ES1000-2020, Standard for Building Code Compliance of Spray-Applied Polyurethane Foam.

6.9 Data in accordance with 2019 ICC 1100 Standard for Spray-applied Polyurethane Foam Plastic Insulation.

6.10 Test reports are from laboratories in compliance with ISO/IEC 17025.

7.0 STATEMENT OF RECOGNITION

This evaluation report describes the results of research completed by IAPMO Uniform Evaluation Service on Heatlok® HFO Pro to assess conformance to the codes and standards shown in Section 1.0 of this report and documents the product's certification. The product is manufactured at location noted in Section 2.9 of this report under a quality control program with periodic inspections under the supervision of IAPMO UES

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



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TABLE 2 - ALTERNATIVE THERMAL BARRIER ASSEMBLY

FIRE-PROTECTIVE COATING/COVERING ¹			MAXIMUM SPF THICKNESS (inch)	
TYPE	MINIMUM THICKNESS	THEORETICAL APPLICATION RATE (COATINGS ONLY)	WALLS AND VERTICAL SURFACES	CEILING AND OVERHEAD SURFACES
DC315 ²	18 mils WFT (12 mils DFT)	1.1 gal/100 ft ²	7.5	11.5
Blazelok TBX ³	18 mils WFT (12 mils DFT)	1.1 gal/100 ft ²	7.5	11.5

For SI: 1 inch = 25.4 mm, 1 gallon = 3.785 L, 1 ft² = 0.0929 m²

¹ Fire-protective coatings and coverings shall be applied over all exposed SPF surfaces in accordance with the coating/covering manufacturer's instructions and this report.

² International Fireproof Technology, Inc, recognized in [IAPMO UES ER-499](#).

³ ICP Construction, recognized in ICC-ES ESR-3997

TABLE 3 – NFPA 285 COMPLYING EXTERIOR WALL ASSEMBLIES WITH HEATLOK® HFO PRO IN WALL CAVITY

Wall Component	Materials
Base Wall System (BWS)- Use either 1, 2, or 3	- Concrete Wall. - Concrete Masonry Wall. 1 layer of 5/8-inch-thick Type X gypsum wallboard installed on the interior side of minimum 3 5/8-inch deep, minimum 25-gauge equivalent thick steel studs spaced a maximum of 24 inches on center. Lateral bracing installed minimum every 4 foot vertically or as required.
Perimeter Fire Barrier System Use 1 and 2	- Perimeter fire barrier system complying with Section 715.4 of the IBC shall be installed, as applicable, to fill the void between the edge of the concrete floor slab and the interior surface of the exterior wall assembly. 4 pcf mineral wool in each stud cavity at each floor line, attached with Z-clips or friction fit.
Interior Insulation – Use either 1, 2, 3, 4 or 5 or combinations of 3 with 4 or 3 with 5.	- None - Maximum of 3 5/8-inch thickness of Heatlok® HFO Pro applied to interior surface of BWS 1 and 2¹ - Full wall stud cavity depth or less of Heatlok® HFO Pro applied using exterior gypsum sheathing of BWS 3 as the substrate and covering the width of the cavity and the inside of the steel wall stud framing flange. - Fiberglass batt insulation (faced or unfaced). - Mineral wool insulation (faced or unfaced).
Exterior Sheathing	5/8-inch-thick exterior type gypsum sheathing (for BWS 3 above).
Exterior wall covering ² – use either 1, 2 or 3	- Any non-combustible exterior wall covering material using any standard installation technique. - Any non-combustible exterior wall covering system with a combustible water-resistive barrier (WRB) that has successfully been tested in accordance with NFPA 285. - Any combustible exterior wall covering system with or without a combustible WRB that has successfully been tested in accordance with NFPA 285. - Table 4 below – Exterior Insulation 2 only with Claddings 6, 7 and 8 per Table 4 of this report (SPF as Exterior Insulation). Read notes carefully. - Table 4 below – Exterior Insulation 3 (with coating) only with Cladding 9 thru 18 per Table 4 of this report (SPF as Exterior Insulation). Read notes carefully.
Flashing of windows, doors, and other exterior wall penetrations	As an option, flash around windows, doors, and other exterior wall penetrations with limited amounts of maximum 12-inch-wide flashing tape (acrylic, asphalt or butyl based) or liquid applied membrane material with or without fiber mesh reinforcement.
Window Perimeter	The window header, jambs and sill are covered with 0.080-inch aluminum flashing. The edges and top of the assembly were sealed with steel flashing. Windows and Doors shall be framed as required for the base wall.

For SI: 1 inch = 25.4 mm; 1lb/ft³=16 kg/m³

¹ Fireblocking per Section 718 of the 2021, 2018, 2015, and 2012 IBC and Section 717 of the 2009 IBC and thermal barrier material requirements must be met for BWS 1 and 2, as required by specific wall construction details when combustible concealed space is created on the exterior side of the exterior wall assembly.

² Combustible exterior wall coverings shall be installed in accordance with manufacturer's installation requirements.

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TABLE 4 – NFPA 285 COMPLYING EXTERIOR WALL ASSEMBLIES WITH HEATLOK® HFO INSTALLED ON THE EXTERIOR SIDE OF THE WALL ASSEMBLY

Wall Component	Materials
Base Wall System (BWS)- Use either 1, 2, or 3	- Concrete Wall. - Concrete Masonry Wall. 1 layer of 5/8-inch-thick Type X gypsum wallboard installed on the interior side of minimum 3 5/8-inch deep, minimum 25-gauge equivalent thick steel studs spaced a maximum of 24 inches on center. Lateral bracing installed minimum every 4 foot vertically or as required.
Perimeter Fire Barrier System Use 1 or 2.	- Perimeter fire barrier system complying with Section 715.4 of the IBC shall be installed, as applicable, to fill the void between the edge of the concrete floor slab and the interior surface of the exterior wall assembly. - Wall stud cavities shall be filled at each floor line with minimum 4 lb/ft³ mineral wool friction fit between steel wall studs, attached with Z-clips or friction fit.
Interior Insulation – Use either 1, 2, 3, 4 or 5 or combinations of 3 with 4 or 3 with 5.	- None - Full wall stud cavity depth or less of Heatlok® HFO Pro applied using exterior gypsum sheathing of BWS 3 as the substrate and covering the width of the cavity and the inside of the steel wall stud framing flange.¹ - Fiberglass batt insulation (faced or unfaced) - Mineral wool insulation (faced or unfaced)
Exterior Sheathing – use either 1 or 2	- None (for BWS 1 or 2 above) 5/8-inch thick Type X exterior type gypsum sheathing (for BWS 3 above)
Exterior Insulation Use 1, 2, or 3	- Maximum 3 1/2-inch thickness of Heatlok® HFO Pro (with Claddings 1-5, 2-inch maximum air gap between cladding and SPF). - Maximum 3-inch HeatLok HFO Pro SPF (with Claddings 6, 7 and 8. Horizontal purlin every 2 feet maximum, no vertical Z girts. Purlin depth 1-inch deeper than SPF thickness. 1-inch maximum air gap between cladding and SPF. - Maximum 3 3/4-inch HeatLok HFO Pro (with Claddings 9-18, use coating – 18 mils WFT DC315 with nine mils WFT Sherwin Williams Sher-Cryl HPA Topcoat with horizontal Z Girts 28 inches on center. 2-inch maximum air gap between cladding and SPF.
Exterior wall covering – use any item 1-20 with specific insulation or coating – read carefully. IMPORTANT Use 1-5 only with Exterior Insulation 1 Use 6, 7 and 8 only with Exterior Insulation 2 Use 9-18 only with Exterior Insulation 3 1-inch maximum air gap between cladding and SPF for cladding 6, 7 and 8 and insulation 2. 2-inch maximum air gap with cladding 1-5 or claddings 9 through 18.	For use with Exterior Insulation 1 - Brick – Standard type brick veneer anchors, installed a maximum of 24 inches on center, vertically on each stud with maximum 1-inch air gap between exterior insulation and brick. Brick to be standard nominal 4-inch thick clay brick installed in a running bond pattern using Type S mortar. - Stucco – Minimum 3/4-inch thick, exterior plaster and lath. A secondary water resistive barrier (WRB) can be installed between the exterior insulation and lath. The secondary WRB shall not be full coverage asphalt or butyl based self-adhered membranes. - Minimum 2-inch thick natural stone (granite, limestone, marble or sandstone) Any standard non-open joint installation technique shall be used. - Minimum 1 1/2-inch thick concrete masonry unit (CMU), precast concrete or artificial cast stone. Any standard non-open jointed method shall be used. - Minimum 1 1/4-inch thick terra cotta non-open jointed. Any standard non-open jointed installation technique shall be used. For use with Exterior Insulation 2 - Vertical or horizontal flat 20 gauge minimum steel (or zinc galvanized steel) panels directly attached to horizontal purlin. Non-open joint. - STK 1000, STK 1500 Force Five, STK 2000, STK 2500 Force Five, STK 5000 or STK 5500 Force Five panels or equivalent. Non-open joint. - Vertical or horizontal corrugated 20 gauge minimum steel (or galvanized steel) panels (2-inch maximum corrugation depth) directly attached to horizontal purlin with no air gap (between cladding and SPF) at the shallowest depth of corrugation profile. Non-open joint. For use with Exterior Insulation 3 - Aluminum cladding – 3 mm minimum thickness, open or non-open joint. - Steel cladding - 0.0149-inch minimum thickness, open or non-open joint. - Copper cladding – 0.0216-inch minimum thickness, open or non-open joint. - Zinc cladding – 4 mm minimum thickness, open or non-open joint. 1/4-inch minimum fiber cement cladding, open or non-open joint

(continued on next page)



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	14. Concrete – minimum 1-inch thick, open or non-open joint. 15. Concrete Masonry Units – minimum 1-inch thick open or non-open joint 16. Stone Veneer – minimum 1-inch thick, open or non-open joint. 17. One Coat Stucco – 3/8-inch minimum exterior cement plaster and lath, non-open joint. 18. Thin Brick adhered (with noncombustible mortar) to stucco base (minimum 3/4-inch) non-open joint.
Flashing of window, door and other exterior wall penetrations	As an option, flash around window, door and other exterior wall penetrations with limited amounts of maximum 12-inch wide flashing tape (acrylic, asphalt, or butyl based) or liquid applied membrane material with or without fiber mesh reinforcement.
Window Perimeter	Materials for Openings Perimeters For Exterior Insulations 1 or 2 with no coating over the foam, use 18 gauge minimum sheet steel perimeter flashing. Windows and doors shall be framed as required for the base wall. For Exterior Insulation 3 with the coating over the foam, use 26 gauge minimum aluminum perimeter flashing. Windows and doors shall be framed as required for the base wall.

For SI: 1 inch = 25.4 mm; 1lb/ft³=16 kg/m³

¹Fireblocking per Section 718 of the 2021, 2018, 2015, and 2012 IBC and Section 717 of the 2009 IBC and thermal barrier material requirements must be met for BWS 1 and 2, as required by specific wall construction details when combustible concealed space is created on the interior side of the exterior wall assembly.



ICC-ES Evaluation Report

ESR-4073

Reissued August 2025

Revised April 2026

Subject to renewal August 2026

This report also contains:

- [CA Supplement](#)

- [SI Supplement](#)

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DIVISION: 07 00 00— THERMAL AND MOISTURE PROTECTION Section: 07 21 00— Thermal Insulation	REPORT HOLDER: HUNTSMAN BUILDING SOLUTIONS, LLC	EVALUATION SUBJECT: HEATLOK® HFO HIGH LIFT SPRAY FOAM INSULATION	
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1.0 EVALUATION SCOPE

1.1 Compliance with the following codes:

- 2024, 2021, 2018, 2015, 2012 and 2009 [International Building Code® \(IBC\)](#)
- 2024, 2021, 2018, 2015, 2012 and 2009 [International Residential Code® \(IRC\)](#)
- 2024, 2021, 2018, 2015, 2012 and 2009 [International Energy Conservation Code® \(IECC\)](#)

Properties evaluated:

- Surface-burning characteristics
- Physical properties
- Thermal resistance
- Attic and crawl space installation
- Water vapor transmission
- Air permeability
- Exterior walls in Types I through IV construction

1.2 Evaluation to the following green standard:

- 2008 ICC 700 [National Green Building Standard™](#) (ICC 700-2008)

2.0 USES

Heatlok® HFO closed cell spray foam is a spray-applied polyurethane foam plastic insulation used as a nonstructural thermal insulating material in all Types of construction (Types I, II, III, IV and V) under the IBC; and in dwellings under the IRC. The insulation is intended for use in wall cavities, floor/ceiling assemblies, the underside of on-grade slabs, or attics and crawl spaces when installed in accordance with Section 4.4. Under the IRC and 2024, 2021, 2018 and 2015 IBC, the insulation may be used as air-impermeable insulation when installed in accordance with Section 3.5.

The insulation may be used in exterior walls of Type I, II, III or IV construction when used as described in Section 4.5.

The attributes of the insulation have been verified as conforming to the provisions of ICC 700-2008 Section 703.2.1.1.1(c) as an air impermeable insulation. Note that decisions on compliance for those areas rest with the user of this report. The user is advised of the project-specific provisions that may be contingent upon meeting specific conditions, and the verification of those conditions is outside the scope of this report. These codes or standards often provide supplemental information as guidance.

3.0 DESCRIPTION

3.1 General:

Heatlok[®] HFO product is a rigid, medium-density, spray-applied cellular polyurethane foam plastic insulation installed as a component of wall assemblies, ceilings, floors, crawlspace and cavities of roofs. The foam plastic insulation is a two-component, closed-cell, one-to-one by volume spray foam system with a nominal density of 2.0 pcf (32 kg/m³). The insulation is produced in the field by combining a polymeric isocyanate (A component) with a polymeric resin blend (B component). The insulation components have a shelf life of six months when stored in factory-sealed containers at temperatures between 50°F (10°C) and 80°F (26°C). The Heatlok[®] HFO product meets or exceeds the minimum requirements set forth in Section 2603.1.1 of the 2024 and 2021 IBC.

3.2 Surface-burning Characteristics:

Heatlok[®] HFO product, at a maximum thickness of 4 inches (102 mm) and a nominal density of 2.0 pcf (32 kg/m³), has a flame spread index of 25 or less and a smoke-developed index of 450 or less when tested in accordance with ASTM E84 (UL 723). There are no thickness limitations when insulation is covered by a code-prescribed 15-minute thermal barrier.

3.3 Thermal Resistance (*R*-values):

Heatlok[®] HFO product has thermal resistance (*R*-value), at a mean temperature of 75°F (24°C), as shown in [Table 1](#).

3.4 Vapor Permeance:

Heatlok[®] HFO has a vapor permeance of 1.0 perm or greater and less than 10 perms when applied at a minimum of 1 inch (25.4 mm) thickness and may be used where a Class III vapor retarder is required by the applicable code.

3.5 Air Permeability:

Heatlok[®] HFO foam plastic insulation, at a minimum 1-inch (25.4 mm) thickness, is considered air-impermeable insulation in accordance with 2024, 2021, 2018, 2015 and 2012 IRC Section R806.5 (2009 IRC Section R806.4) and 2024, 2021 and 2018 IBC Section 1202.3 (2015 IBC Section 1203.3) based on testing in accordance with ASTM E283.

3.6 DC 315 Intumescent Coating:

DC 315 intumescent coating (see [ESR-3702](#)), manufactured by International Fireproof Technology, Inc., is a water-based coating supplied in 5-gallon (19L) pails and 55-gallon (208L) drums and has a shelf life of one (1) year when stored in factory-sealed containers at temperatures between 50°F (10°C) and 80°F (24°C).

4.0 DESIGN AND INSTALLATION

4.1 General:

Heatlok[®] HFO product must be installed in accordance with the manufacturer's published installation instructions and this report. A copy of the manufacturer's published installation instructions must be available at all times on the jobsite during installation.

4.2 Application:

The insulation is spray-applied on the jobsite using equipment identified in the manufacturer's published installation instructions. The Huntsman Building Solutions Heatlok[®] HFO product must be applied when the ambient and substrate temperature is between 10°F (-12°C) and 120°F (49°C). The insulation must not be used in areas that have a maximum service temperature greater than 180°F (82°C). The foam plastic insulation must not be used in electrical outlet or junction boxes or in contact with rain or water. The substrate must be free of moisture, frost or ice, loose scales, rust, oil and grease, or contaminants that will interfere with adhesion of the spray foam insulation. The Huntsman Building Solutions Heatlok[®] HFO product may be applied in passes having a maximum thickness of 6½ inches (165 mm) per pass. When multiple passes are required, subsequent passes can be sprayed once the core temperature drops below 100°F (37.7°C).

4.3 Thermal Barrier:

4.3.1 Application with a Prescriptive Thermal Barrier: Heatlok[®] HFO insulation must be separated from the interior of the building by an approved thermal barrier of ½-inch-thick (12.7 mm) gypsum wallboard or an equivalent thermal barrier complying with and installed in accordance with the applicable code except where the installation complies with the requirements set forth in Section 4.3.2. When installation is within an attic or crawl space as described in Section 4.4, a thermal barrier is not required between the foam plastic and the attic or crawl space, but is required between the insulation and the interior of the building.

There is no thickness limit when installed behind a code-prescribed thermal barrier except as noted in Section 4.4.2.1.

4.3.2 Application without a Prescriptive Thermal Barrier: Heatlok® HFO spray foam insulation may be installed without the prescriptive 15-minute thermal barrier or ignition barrier described in Section 4.3.1 or Section 4.4.1, respectively, when installation is in accordance with the following:

4.3.2.1 The insulation must be covered on all surfaces with the intumescent coating specified in Section 3.6 at the minimum coating thickness specified in [Table 2](#).

4.3.2.2 The maximum installed thickness of the insulation must not exceed the insulation thickness specified in [Table 2](#).

4.3.3 The intumescent coating must be applied over the insulation in accordance with the coating manufacturer's instructions, ICC-ES evaluation report [ESR-3702](#) for the coating and this report.

4.4 Ignition Barrier – Attics and Crawl Spaces:

4.4.1 Application with a Prescriptive Ignition Barrier: When Heatlok® HFO insulation is installed within attics or crawl spaces where entry is made only for service of utilities, an ignition barrier must be installed in accordance with IBC Section 2603.4.1.6 and 2024 IRC Sections R303.5.3 and R303.5.4 (2021, 2018, 2015, 2012 and 2009 IRC Section R316.5.3 and R316.5.4), as applicable, except when the installation is in accordance with Section 4.4.2. The ignition barrier must be consistent with the requirements for the type of construction required by the applicable code, and must be installed in a manner so that the foam plastic insulation is not exposed. The attic or crawl space area must be separated from the interior of the building by an approved 15-minute thermal barrier as described in Section 4.3.1.

Heatlok® HFO insulation, as described in this section, may be installed in unvented attics in accordance with 2024, 2021, 2018, 2015 and 2012 IRC Section R806.5 (2009 IRC Section R806.4) or 2024, 2021 and 2018 IBC Section 1202.3 (2015 IBC Section 1203.3).

4.4.2 Application without a Prescriptive Ignition Barrier: Where the spray-applied insulation is installed in accordance with Section 4.4.2.1, the following conditions apply:

- a) Entry to the attic or crawl space is to only service utilities, and no storage is permitted.
- b) There are no interconnected attic or crawl space areas.
- c) Air in the attic or crawl space is not circulated to other parts of the building.
- d) Attic ventilation is provided when required by 2024, 2021 and 2018 IBC Section 1202.2 (2015, 2012 and 2009 IBC Section 1203.2) or IRC Section R806, except when air-impermeable insulation is permitted in unvented attics in accordance with the 2024, 2021 and 2018 IBC Section 1202.3 (2015 IBC Section 1203.3) or 2024, 2021, 2018, 2015 and 2012 IRC Section R806.5 (2009 IRC Section R806.4), as applicable.
- e) Under-floor (crawl space) ventilation is provided when required by 2024, 2021 and 2018 IBC Section 1202.4 [2015 IBC Section 1203.4 (2012 and 2009 IBC Section 1203.3)] or IRC Section R408.1, as applicable.
- f) Combustion air is provided in accordance with *International Mechanical Code*® Section 701.
- g) If hot work is to be performed, all necessary procedures, precautions and limitations must be observed in accordance with OSHA 1926 Subpart J Standard 1926.352 requirements for hot work (welding / cutting) performed in the vicinity of combustible materials.
- h) An installation certificate with the following information must be posted at each entrance:
 - Product name and installation thickness.
 - Manufacturer name, address and contact information.
 - Installation contractor name, address and contact information.
 - Attestation that the product(s) have been installed in accordance with the manufacturer's installation instructions and the requirements of the evaluation report.
 - A notice that the certificate is not to be removed or altered.
 - A list of limitations for the space including the following:
 - Entry to the space is only to service utilities, and no storage is permitted.
 - FIRE SAFETY WARNING: If hot work is to be performed, all necessary procedures, precautions and limitations must be observed in accordance with OSHA 1926 Subpart J Standard 1926.352 requirements for hot work (welding / cutting) performed in the vicinity of combustible materials.

4.4.2.1 Application without a Prescriptive Ignition Barrier: In attics and crawl spaces, Heatlok® HFO insulation may be spray-applied to the underside of roof sheathing and/or rafters, and to vertical surfaces and the underside of floors as described in this section. The thickness of the foam plastic applied to the underside of the overhead surfaces (roof sheathing, rafters and the underside of floors) must not exceed 1 1/4 inches (286 mm). The thickness of the foam plastic applied to vertical surfaces must not exceed 7 1/4 inches (184 mm).

The attic or crawl space must be separated from the interior of the building by an approved thermal barrier as described in Section 4.3.1.

4.4.3 Use on Attic Floors: Heatlok® HFO insulation may be installed at a maximum thickness of 11¼ inches (286 mm) between and over joists in attic floors. The Heatlok® HFO insulation must be separated from the interior of the building by an approved thermal barrier.

4.5 Exterior Walls of Type I, II, III and IV Construction:

4.5.1 General: When used on exterior walls of Type I, II, III, and IV construction, the assembly must comply with Section 2603.5 of the IBC and this section, and the Heatlok® HFO insulation must be installed at a maximum thickness described in [Tables 3 and 4](#). The potential heat of Heatlok® HFO insulation is 2300 Btu/ft² (26 MJ/m²) per inch of thickness when tested in accordance with NFPA 259.

4.5.2 Specific Wall Assemblies: Wall assemblies complying with Section 4.5 must be as described in [Table 3](#) under the 2018, 2015, 2012 and 2009 IBC and [Table 4](#) under the 2024, 2021, 2018, 2015, 2012 and 2009 IBC.

5.0 CONDITIONS OF USE:

The Heatlok® HFO spray foam insulation described in this report complies with, or is a suitable alternative to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

- 5.1 The products must be installed in accordance with the manufacturer's published installations instructions, this evaluation report and the applicable code. If there are any conflicts between the manufacturer's published installation instructions and this report, this report governs.
- 5.2 The insulation must be separated from the interior of the building by an approved thermal barrier, except when installation is as described in Sections 4.3.2. A thermal barrier must be installed between the insulation and the interior space above (crawl space) or below (attic).
- 5.3 The insulation must not exceed the thicknesses noted in this report based upon the intended end use.
- 5.4 The insulation must be protected from exposure to weather during and after application.
- 5.5 The insulation must be applied by contractors authorized by Huntsman Building Solutions, LLC.
- 5.6 Use of the insulation in areas where the probability of termite infestation is "very heavy" must be in accordance with 2024, 2021, 2018, 2015, and 2009 IBC Section 2603.8 (2012 IBC Section 2603.9) or IRC Section 2024 IRC Section R305.4 (2021, 2018, 2015, 2012 and 2009 R318.4), as applicable.
- 5.7 When use is on exterior walls of buildings of Types I, II, III, and IV under the IBC, construction must be as described in Section 4.5.
- 5.8 Jobsite certification and labeling of the insulation must comply with 2024, 2021, 2018 or 2015 IRC Sections N1101.10.1 and N1101.10.1.1 (2012 IRC Sections N1101.12.1 and N1101.12.1.1 or 2009 IRC Sections N1101.4 and N1101.4.1) and 2024, 2021, 2018, 2015 and 2012 IECC Sections C303.1.1, C303.1.1.1, R303.1.1 and R303.1.1.1 (2009 IECC Sections 303.1.1 and 303.1.1.1), as applicable.
- 5.9 When installed in accordance with Section 4.4.2 of this report, the associated installation certificate(s) containing the required information referenced in Section 4.4.2 must be installed at each entrance to the crawlspace or attic, as applicable. The certificate(s) must be red in color and constructed of durable materials, such as metal, plastic, or laminated paper.
- 5.10 When used in unvented attics in accordance with Section 4.4.2 of this report, installation with a vapor diffusion port in accordance with 2024 and 2021 IBC Section 1202.3, Item 5.2 or 2024, 2021 and 2018 IRC Section R806.5, Item 5.2 is outside the scope of this report.
- 5.11 The insulation components A and B are produced in Arlington, Texas and Mississauga, Ontario, Canada, under a quality control program with inspections by ICC-ES.

6.0 EVIDENCE SUBMITTED

- 6.1 Data in accordance with the ICC-ES [Acceptance Criteria for Spray-applied Foam Plastic Insulation \(AC377\)](#), dated June 2023 (editorially revised June 2024), including reports of tests in accordance with AC377 Appendix X.
- 6.2 Reports of air leakage testing in accordance with ASTM E283.
- 6.3 Reports of water vapor transmission test in accordance with ASTM E96.
- 6.4 Reports of room corner tests in accordance with NFPA 286.
- 6.5 Reports of fire propagation characteristics tests in accordance with NFPA 285.
- 6.6 Reports of potential heat of foam plastic tests in accordance with NFPA 259.
- 6.7 Supplementary fire engineering analysis.

7.0 IDENTIFICATION

- 7.1 The ICC-ES mark of conformity, electronic labeling, or the evaluation report number (ICC-ES ESR-4073) along with the name, registered trademark, or registered logo of the report holder must be included in the product label.
- 7.2 In addition, components of the insulation are identified with the manufacturer's name [Huntsman Building Solutions, LLC], address and telephone number; the product name (Heatlok[®] HFO B-side or A-PDMI); use instructions; the density; the flame-spread and smoke-developed indices; and the date of manufacture; thermal resistance values.

The International Fireproof Technology, Inc. / Paint To Protect, Inc. DC 315 intumescent coating is identified with the manufacturer's name, the product trade name, use instructions and ICC-ES evaluation report number [ESR-3702](#).

- 7.3 The report holder's contact information is the following:

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3315 EAST DIVISION STREET
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(817) 640-4900
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TABLE 1—THERMAL RESISTANCE (R-VALUES)

THICKNESS (inches)	R-VALUE (°F.ft ² .h/Btu)	THICKNESS (inches)	R-VALUE (°F.ft ² .h/Btu)
1.0	6.3	7.0	52
1.5	10	7.5	56
2.0	14	8.0	60
2.5	18	8.5	64
3.0	22	9.0	67
3.5	26	9.5	71
4.0	30	10.0	75
4.5	34	10.5	79
5.0	37	11.0	82
5.5	41	11.5	86
6.0	45	12.0	90

For SI: 1 inch = 25.4 mm; 1°F.ft².h/Btu = 0.176 110°K.m²/W.

¹R-values are calculated based on tested K-values at 1- and 4-inch thicknesses.

TABLE 2—USE OF INSULATION WITHOUT A PRESCRIPTIVE THERMAL BARRIER (TESTED IN ACCORDANCE WITH NFPA 286)

INSULATION TYPE	MAXIMUM THICKNESS (in.) (Vertical Surfaces)	MAXIMUM THICKNESS (in.) (Overhead Surfaces)	COATING TYPE & MINIMUM THICKNESS ^{2,3} (Applied to all Foam Surfaces)	MINIMUM APPLICATION RATE OF COATING ²
Heatlok HFO	7½	11½	DC 315 18 mils WFT 12 mils DFT	1.125 gal / 100 ft ²

For SI: 1 inch = 25.4 mm; 1 mil = 0.0254 mm; 1 gallon = 3.78 L; 1 ft² = 0.93 m².

Notes: ¹See Section 4.3.2.

²DFT = Dry Film Thickness; WFT = Wet Film Thickness

³See Section 3.6.

TABLE 3—NFPA 285 COMPLYING EXTERIOR WALL ASSEMBLIES – WALL CAVITY INSULATION^{1,2}

WALL COMPONENT	MATERIALS
Base Wall System – Use either 1, 2 or 3	1 – Concrete wall. 2 – Concrete masonry wall. 3 – Minimum 3 ⁵ / ₈ -inch-deep (92 mm), No. 25 gage, C-shaped steel studs, spaced a maximum of 24 inches on center with lateral bracing every 4 feet (1219 mm) as required by code. Interior sheathing must be 1 layer ⁵ / ₈ -inch-thick (19.1 mm) Type X gypsum wallboard complying with ASTM C1396. Exterior Sheathing shall be as described in Exterior Sheathing below.
Floorline Firestopping	Minimum 4 pcf mineral wool in each stud cavity at each floorline, attached with Z-clips. Thickness must match stud cavity depth.
Perimeter Fire Barrier System	Perimeter fire barrier system complying with 2018, 2015 and 2012 IBC Section 715.4 (2009 IBC Section 714.4) must be installed to fill the void between the edge of the concrete floor slab and the interior surface of the exterior wall assembly.
Cavity / Interior Insulation – Use either 1, 2, 3, 4 or 5; (Note: Cavity Insulation No. 3 may be combined with No. 4 or Cavity Insulation No. 3 may be combined with No. 5 to achieve depth of insulation required)	1 – None. 2 – 3 ⁵ / ₈ inches (92 mm) of Heatlok [®] HFO applied to the interior surface of Base Wall System 1 or 2 ^a . 3 – Full cavity depth not exceeding 3 ⁵ / ₈ inches (92 mm) of Heatlok [®] HFO. 3 – Any insulation qualified as noncombustible in accordance with ASTM E136. 4 – Glass fiber batt insulation ^b . 5 – Mineral fiber insulation ^b . ^a Fireblocking in accordance with 2018, 2015 and 2012 IBC Section 718 (2009 IBC Section 717) and thermal barrier material requirements in accordance with IBC Section 2603.4 shall be met for Base Wall Systems 1 and 2, when a combustible concealed space is present on interior side of the exterior wall assembly. ^b Insulation must comply with the applicable requirements of 2018, 2015 or 2012 IBC Section 720.2 (2009 IBC Section 719.2).
Exterior Sheathing – Only for Base Wall System No.3 –	Minimum ⁵ / ₈ -inch-thick (19.1 mm) glass mat gypsum sheathing complying with ASTM C1177. Sheathing shall be attached with No. 6, 1 ¹ / ₄ -inch-long (32 mm) self-tapping screws located 8 inches (203 mm) on center along the perimeter and 12 inches (302 mm) on center in the field of wallboard. Joints must be taped and treated with joint compound in accordance with ASTM C840 or GA-216.
Exterior Wall Covering – Use either 1 or 2	1 – Any noncombustible exterior wall covering material using any standard installation technique (Base Wall 1 or 2) 2 – Any noncombustible exterior wall covering system with a combustible WRB that has successfully been tested in accordance with NFPA 285, (Base Wall 3) Details of the exterior wall covering must be provided to the code official by the report holder, designer or specifier, with an engineering analysis demonstrating that (1) the exterior wall covering conforms to ASTM E136 and (2) the addition of the wall covering and/or water-resistive barrier to the assembly described in this section does not negatively affect conformance of the assembly with the requirements of IBC Section 2603.5.

¹ When used on exterior walls of Types I, II, III or IV construction, the specific wall assembly must comply with 2018, 2015, 2012 and 2009 IBC Section 2603.5.

² The exterior wall assemblies described in Table 3 comply with 2018, 2015, 2012 and 2009 IBC Section 2603.5.5.

TABLE 4—NFPA 285 COMPLYING EXTERIOR WALL ASSEMBLIES – WALL CAVITY INSULATION^{1,2}

WALL COMPONENT	MATERIALS
Base Wall System –	1–Minimum 3 ⁵ / ₈ -inch-deep (92 mm), No. 20 gage, C-shaped steel studs, spaced a maximum of 24 inches (610 mm) on center with lateral bracing every 4 feet (1219 mm) as required by code. Interior sheathing must be 1 layer ⁵ / ₈ -inch-thick (19.1 mm) Type X gypsum wallboard complying with ASTM C1396. Exterior Sheathing shall be as described in Exterior Sheathing below.
Floorline Firestopping	Minimum 4 pcf mineral wool in each stud cavity at each floorline, attached with Z-clips. Thickness must match stud cavity depth.
Perimeter Fire Barrier System	Perimeter fire barrier system complying with 2024, 2021, 2018, 2015 and 2012 IBC Section 715.4 (2009 IBC Section 714.4) must be installed to fill the void between the edge of the concrete floor slab and the interior surface of the exterior wall assembly.
Cavity / Interior Insulation	None
Exterior Sheathing	Minimum ¹ / ₂ -inch-thick (12.7 mm) glass mat gypsum sheathing complying with ASTM C1177. Sheathing shall be attached with No. 6, 1 ¹ / ₄ -inch-long (32 mm) self-tapping screws located 8 inches (203 mm) on center along the perimeter and 12 inches (302 mm) on center in the field of wallboard. Joints must be taped and treated with joint compound in accordance with ASTM C840 or GA-216.
Exterior Insulation	Maximum 8-inch-thick (203 mm) Heatlok [®] HFO insulation.
Exterior Wall Covering	Nominal 4-inch-thick (101.6 mm) common clay brick installed in running bond pattern in accordance with the code with a 1-inch (25.4 mm) air gap between back of brick and exterior insulation. Window opening must be flashed with minimum 0.05-inch-thick (1.3 mm) steel flashing.

For SI: 1 inch = 25.4 mm.

¹ When used on exterior walls of Types I, II, III or IV construction, the specific wall assembly must comply with 2024, 2021, 2018, 2015, 2012 and 2009 IBC Section 2603.5.

² The exterior wall assemblies described in Table 4 comply with 2024, 2021, 2018, 2015, 2012 and 2009 IBC Section 2603.5.5.

DIVISION: 07 00 00—THERMAL AND MOISTURE PROTECTION
Section: 07 21 00—Thermal Insulation

REPORT HOLDER:

HUNTSMAN BUILDING SOLUTIONS, LLC

EVALUATION SUBJECT:

HEATLOK® HFO HIGH LIFT SPRAY FOAM INSULATION

1.0 REPORT PURPOSE AND SCOPE**Purpose:**

The purpose of this evaluation report supplement is to indicate that the Heatlok® HFO High Lift Spray Foam Insulation, described in ICC-ES evaluation report [ESR-4073](#), has also been evaluated for the codes noted below.

Applicable code editions:

- 2025 California Building Code (CBC)

For evaluation of applicable chapters adopted by the California Office of Statewide Health Planning and Development (OSHPD) AKA: California Department of Health Care Access and Information (HCAI) and the Division of the State Architect (DSA), see Sections 2.1.1 and 2.1.2 below.

- 2025 California Residential Code (CRC)
- 2025 California Energy Code (CEC)

2.0 CONCLUSIONS**2.1 CBC and CRC:**

The Heatlok® HFO High Lift Spray Foam Insulation, described in Sections 2.0 through 7.0 of the evaluation report [ESR-4073](#), complies with the 2025 CBC and CRC, provided the design and installation are in accordance with the 2024 *International Building Code*® (IBC) and 2024 *International Residential Code*® (IRC) provisions noted in the evaluation report.

2.1.1 OSHPD:

The applicable OSHPD Sections and Chapters of the CBC are beyond the scope of this supplement.

2.1.2 DSA:

The applicable DSA Sections and Chapters of the CBC are beyond the scope of this supplement.

2.2 CEC:

The Heatlok® HFO High Lift Spray Foam Insulation, described in Sections 2.0 through 7.0 of the evaluation report [ESR-4073](#), complies with the 2025 CEC, provided the design and installation are in accordance with the 2024 *International Building Code*® (IBC) provisions noted in the evaluation report.

2.2.1 Conditions of Use:

In accordance with Section 110.8 of the 2025 California Energy Code, verification of certification by the Department of Consumer Affairs, Bureau of Household Goods and Services, must be provided to the code official, demonstrating that the insulation conductive thermal performance is approved pursuant to the California Code of Regulations, Title 24, Part 12, Chapters 12-13, Article 3, "Standards for Insulating Material." Certification can be verified with the DCA Bureau of Household Goods and Services using the following link to the bureau's Directory of Certified Insulation Materials:
https://bhgs.dca.ca.gov/consumers/ti_directory.pdf

This supplement expires concurrently with the evaluation report, reissued August 2025 and revised April 2026.

ICC-ES Evaluation Report

ESR-4073 Seal & Insulate with
ENERGY STAR® Supplement

Reissued August 2025

Revised April 2026

This report is subject to renewal August 2026.

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DIVISION: 07 00 00—THERMAL AND MOISTURE PROTECTION

Section: 07 21 00—Thermal Insulation

REPORT HOLDER:

HUNTSMAN BUILDING SOLUTIONS, LLC

EVALUATION SUBJECT:

HEATLOK® HFO HIGH LIFT SPRAY FOAM INSULATION

1.0 EVALUATION SCOPE

Conformance to the following:

Seal and Insulate with ENERGY STAR Program, *Definitions and Testing Requirements for Residential Insulation, Version 1.0*

Properties evaluated:

- Thermal resistance
- Surface-burning characteristics

2.0 PURPOSE OF THIS SUPPLEMENT

This supplement is issued to certify that the Heatlok® HFO High Lift Spray Foam Insulation described in Sections 2.0 through 7.0 of the evaluation report ([ESR-4073](#)) have been reviewed for compliance with the applicable codes noted in Section 1.0 of the evaluation report and with the requirements set forth in the Seal and Insulate with ENERGY STAR Program, *Definitions and Testing Requirements for Residential Insulation, Version 1.0*. The insulation product covered by this supplement is defined as "Spray Foam Insulation."

The requirements for testing laboratory qualifications and product sampling, as well as the specific material and test standards and editions used in this evaluation, are as set forth in the applicable documentation noted in Section 6.0 of the evaluation report.

ICC-ES, the Certification Body, has verified that the test results were issued by laboratories accredited as required by the Conditions and Criteria for Recognition of Insulation Certification Bodies for the ENERGY STAR Program.

3.0 DEFINITIONS

The following definitions are from the Definitions and Testing Requirements for Residential Insulation, Version 1.0, and are applicable to the subject of this report.

3.1 General Definition:

Insulation: Any material mainly used to slow down heat flow. It may be mineral or organic, fibrous, cellular, or reflective (aluminum foil). It may be in rigid, semi-rigid, flexible, or loose-fill form.

Residential Buildings: Single family homes (attached or unattached), multifamily buildings with 4 units or fewer, or multifamily buildings (e.g., condominiums and apartments) with 3 stories or less in height above grade.

3.2 Insulation Product Definition:

Spray or Pour Foam Insulation: A thermal insulating material that is sprayed or poured (as a gel or foamy liquid) into place and expands or sets into a cellular foam and cures at the point of installation through a chemical reaction. Foamed materials include, but are not limited to polyurethane, polyisocyanurate, phenolic, and cementitious insulation.

3.3 Insulation Performance Definitions:

R-value: The inverse of the time rate of heat flow through a body from one of its bounding surfaces to the other surface for a unit temperature difference between the two surfaces, under steady state conditions, per unit area. For the purposes of the Seal and Insulate with ENERGY STAR program, only Imperial units will be accepted [(h·ft²·°F)/Btu].

Smoke-Development Index: The characteristic of a material to emit smoke when exposed to flame or fire compared to heptane and inorganic cement.

Flame-Spread Index: The characteristic of a material to resist the spreading of flames when exposed to flame or fire compared to red oak and inorganic cement.

4.0 Insulation Performance:

4.1 Thermal Resistance:

The Heatlok® HFO High Lift Spray Foam Insulation has the thermal resistance *R*-values as noted in Table 1 of [ESR-4073](#), based upon testing.

4.2 Surface Burning Characteristics:

Smoke-Development Index: See Section 3.2 of [ESR-4073](#) for the smoke-development index of the insulation material.

Flame-Spread Index: See Section 3.2 of [ESR-4073](#) for the flame-spread index of the insulation material.

5.0 Installation:

Installation of the Heatlok® HFO High Lift Spray Foam must be in accordance with the requirements set forth in Sections 4.0 and 5.0 (as applicable) of ESR-4073 and Huntsman Building Solution's Installation Instructions dated October 8, 2024, which are reprinted on pages 11 through 31. The installation instructions address use in the following locations of the residence:

- Above grade wall (inside)
- Above grade wall (outside)
- Below grade wall (inside)
- Crawlspace wall (under house)
- Roof or rafters (cathedral ceiling)
- Attic floor
- Attic knee wall
- Ceiling of basement or crawlspace

This supplement expires concurrently with the evaluation report, reissued August 2025 and revised April 2026.



RESIDENTIAL SPRAY FOAM PRODUCT APPLICATION GUIDE FOR HOMEOWNERS

OVERVIEW OF HEALTH AND SAFETY FACTORS TO TAKE INTO ACCOUNT WHEN USING SPRAY POLYURETHANE FOAM (SPF)

This application guide pertains to the spray polyurethane foam insulation products offered by Huntsman Building Solutions for residential use. It serves as a general reference for homeowners. Contractors are advised to consult the complete Application Guides for each specific product to obtain detailed installation parameters and requirements. When applying SPF, it is essential to prioritize health and safety. The subsequent sections address potential hazards associated with SPF application, the proper handling of chemical components, safety practices on the job site, and the necessary personal protective equipment for handling and installing SPF chemicals. This information is derived from the Center for Polyurethane Industries' Guidance on Best Practices for the Installation of Spray Polyurethane Foam, which can be accessed at <https://www.americanchemistry.com>. For more extensive information regarding the health and safety considerations of SPF, additional resources, guidance documents, and training materials are available at www.spraypolyurethane.org.

QUALITY ASSURANCE – INSTALLER QUALIFICATIONS

Only contractors authorized by Huntsman Building Solutions in the art of applying spray polyurethane foam insulation can install the products.

OVERVIEW OF SPRAY POLYURETHANE FOAM'S COMPONENT MATERIALS HEALTH RISKS

Spray polyurethane foam insulation is created through the combination of methylene diphenyl diisocyanate (MDI) and a polyol mixture. Given that these materials may pose health risks, only contractors approved by Huntsman Building Solutions in the application of spray polyurethane foam insulation, and equipped with the appropriate personal protective equipment (PPE) as outlined below, are permitted to handle and install these products. For a visual summary of the required PPE for applicators and assistants, please refer to Figure 1. For further details regarding potential health effects, consult the Material Safety Data Sheets (MSDS) for A-PMDI and B-Side Resin provided by HBS.

RESPIRATORY PROTECTION

In the course of application, the concentration of airborne chemicals may surpass the established exposure guidelines. Consequently, access to the work area and the handling of raw materials is restricted to trained and authorized contractors equipped with appropriate personal protective equipment (PPE). Indoor applications generally necessitate the use of Supplied Air Respirators (SAR), while outdoor applications may call for Air Purifying Respirators. For additional guidance on selecting respirators, please consult the NIOSH Respirator Decision Logic, which is accessible online at www.cdc.gov/niosh/docs/2005-100/pdfs/05-100.pdf.

EYE PROTECTION

It is essential to wear suitable eye protection to safeguard the eyes from accidental splashes of liquids, reactive foams, and other aerosols and particulates that may be encountered during application. When dealing with liquid SPF chemicals in open containers, workers should utilize safety goggles or a combination of safety goggles and face shields to shield their eyes. Additionally, during the application of SPF, eye protection can be enhanced by using a hooded or full-face respirator. Furthermore, having a portable eyewash station readily accessible in the rig or truck, as well as in the immediate work area, and ensuring it is properly covered, can provide additional safety.

CLOTHING & GLOVES

Workers are required to don suitable protective attire whenever there is a risk of direct exposure to SPF component chemicals, particularly during the handling of raw materials and the application of SPF. Applicators and their assistants generally utilize disposable coveralls to prevent spray and mist from coming into contact with their skin and clothing. Fabric gloves that are completely coated with nitrile, neoprene, butyl, or PVC are usually effective in safeguarding SPF applicators. To ensure adequate skin protection, personal protective equipment (PPE) must be worn in a way that leaves no skin exposed.

RE-ENTRY & RE-OCCUPANCY TIMES FOR INTERIOR APPLICATIONS

Only trained, approved and properly protected workers can access the work area during application and for a determined period afterwards. The work area shall be ventilated in accordance with applicable guidance, notably the US Environmental Protection Agency (EPA)'s "Ventilation Guidance for Spray Polyurethane Foam Application", the American Chemistry Council's Center for the Polyurethanes Industry's "Good Practices – Engineering Controls and Ventilation", as well as Federal Regulations for Safety and Health during Construction. Re-entry periods for sprayers, helpers, informed trade workers and contractors will vary depending on the product and ventilation rate being used. For homeowners and building occupants, Huntsman Building Solutions recommends a 24-hour re-occupancy time after the application of SPF when appropriate ventilation is used. Homeowners are encouraged to visit www.spraypolyurethane.org and www.huntsmanbuildingsolutions.com for up to date information about spray foam application standards.

Figure 1 – PPE Guidance for applicators and helpers

High Pressure High Pressure Spray Systems	
	
Routes of Exposure	PPE
Eyes	 FF Mask/ Hood
Skin	Full Body Suits  Full Suit
Hands	Gloves 
Lungs	Air Supply  FF Mask/ Hood or FF Air Purifying Airline OV/Pre-filter Provide Good Ventilation

Figure 1 Source: Center for Polyurethane Industries' Guidance on Best Practices for the Installation of Spray Polyurethane Foam

GENERAL PROCESSING GUIDELINE

HBS spray polyurethane foam (SPF) insulation requires heat from the proportioner to complete the chemical reactions necessary to create foam meeting the specifications on the Technical DataSheet. Fully functional primary heaters and hose heat are needed to process the materials. Please consult the Huntsman Building Solutions Technical Service Department for further assistance.

SUBSTRATE PREPARATION

All surfaces to be sprayed must be free of oil, grease, waxes, rust scale, loose dirt and water. In addition, the substrate must be structurally sound. The moisture content of wood substrates must not exceed 19% before foam is applied. Some metal surfaces may require sandblasting and priming prior to foam spraying to ensure adequate adhesion. Consult a Huntsman Building Solutions Technical Service Representative for additional information on surface preparation. When in doubt about the potential for adhesion to a substrate, build a mock-up and spray the foam under similar conditions to that expected in the field, then test for adhesion and cohesion.

Applying foam insulation to concrete:

- Concrete and masonry must be fully cured and "bone-dry."
- Oils – wash with detergent and allow to dry
- Salt or calcium deposits – wash with detergent and allow to dry
- Muriatic acid can be an effective cleaning agent for preparing concrete substrates prior to spraying foam. Follow the label instructions for dilution and application.

Applying foam insulation to galvanized steel:

- Oils or passivators – clean with solvent, wash with water based cleaner/degreaser, brush blasting may be necessary.
- Do not use hydrocarbon solvents like mineral spirits to clean galvanized metal.
- White rust – wire brushing or scrubbing with a stiff brush or abrasive pad.
- Prime using a DTM (direct to metal) bonding primer suitable for galvanized metal.

Applying foam over previously painted surface:

- Glossy surfaces – sand or abrade surfaces.

Applying foam over bare steel/metal:

- Rust scales – wire brushing or scrubbing with a stiff brush or abrasive pad.
- Corrosion – clean then prime with suitable bonding primer.
- Glossy or very smooth surfaces – sand or abrade surfaces.

Applying foam over stainless steel:

- Oils – wash with mineral spirits and then prime with a suitable primer. Brush blasting, sanding or abrading may be necessary as foam requires a mechanical bond.

Applying foam over aluminum:

- Oils, Hydrated Alumina – clean with solvent, never use a caustic solution, and prime with a high adhesion bonding primer suitable for aluminum.

Applying foam over glass:

- Oils – wash with detergent
- Glossy or very smooth surfaces – sand or abrade surfaces.
- UV degradation – prime glass surface with suitable primer.

Asphalt and Tar:

- Solvents – allow to cure and for solvent to evaporate, prime with suitable primer.

Rigid Polyurethane Foam:

- UV degradation – remove surface of foam with wire brush or wire grinding wheel.

Polypropylene, polyethylene, some silicones and some ceramic surfaces:

- Spray polyurethane foam may not adhere without a mechanical attachment to these substrates.

FOAM APPLICATION

In preparation for spraying, workers will perform an off-target test spray to verify the processing pressure, primary heater and hose temperature settings. Foam application temperatures and pressures can vary widely depending on temperature, humidity, elevation, substrate, equipment and other factors. While processing, the applicator must continuously observe the characteristics of the sprayed foam and adjust processing temperatures and pressures to maintain proper cell structure, adhesion, cohesion and general foam quality.

Spraying sections too thick, too fast may result in charring of the foam, or in extreme conditions a fire may result. Therefore, the maximum thickness per pass and proper wait times between passes should be respected to avoid fire hazards, including spontaneous combustion, resulting from excessive heat generation. Thin foam layers often result in poor physical properties, reduced coverage and poor chemical reaction due to low exothermic heat generated from the chemical reaction, which is needed to create proper cell formation. When multiple layers are necessary to achieve the proper R-value, cross-hatching should be done. This technique aids in proper cohesion of passes.

The temperature of the substrate has a major effect on the foam density and adhesion. Certain compromises are necessary to spray in cold weather. The "COLD WEATHER PROCESSING" section offers more information on this topic. If in doubt about the substrate or the ambient conditions, a trial application should be done to check foam quality and spray performance. Water on the substrate from rain, fog, condensation, etc. will react chemically with the isocyanate, adversely affecting the physical properties, performance and adhesion of the foam. Application on substrates with high relative humidity can also adversely affect the physical properties of the foam.

EXTERIOR FOAM APPLICATION

Climatic conditions are an important factor that should be considered when preparing to apply foam to the exterior of a structure. Ambient and substrate temperatures should be monitored. Foam should only be applied when ambient and substrate temperatures are inside the range for the foam system being used. Foam should only be applied to substrates with less than 19% moisture content. It is best to apply foam when the humidity is less than 80% and the wind is less than 10 mph to maintain proper adhesion. Pay close attention to the temperature of the substrate when applying foam to the exterior of a structure.

Use windscreens downwind, the foam can travel long distances because the particles may separate when airborne. Windscreens can also be configured around scaffolding and man-lifts. It may also be necessary to enclose and preheat the area to the acceptable temperature range for the foam system being used. In preparation for spraying, a test spray should be performed to ensure that the proper processing temperatures and pressures are set. The specified settings per the TDS are general starting parameters, it is important to observe the foam and the reaction time of the reacting mass and make additional adjustments as needed.

COLD STORAGE APPLICATIONS

Cold storage facilities require vapor barriers. Vapor barriers are typically applied to the warm side of the insulation system. Closed-cell spray foam is classified as a class II vapor barrier above a certain thickness. When spraying in freezers, use 1" (25mm) lift passes. Thicker passes in deep freezers can lead to severe cracking. Freezers require closed-cell 2 lb foam, using lower density foam or an over catalyzed foam can also lead to severe cracking. Proper surface preparation may be necessary prior to the application of closed-cell spray foam in cold storage applications. Contact the Huntsman Building Solutions Technical Service Department for more information about cold storage applications.

Materials used to construct refrigerated rooms are affected by temperature changes, like all common building materials. Gradual lowering of the temperature is designed to eliminate problems stemming from these temperature changes while at the same time withdrawing construction moisture, and testing the vapor barrier and mechanical system.

HOW TO AVOID OVER SPRAY

Over spray with spray foam occurs for a variety of reasons such as spraying the product too cool, applying the product to a substrate that is too cold, not spraying perpendicular to the surface, and high wind conditions. Flash coating to warm the surface is not a recommended practice and may create unwanted over spray. Flash coats are very thin and may not have enough exothermic reaction present to properly cure. Excessive over spray may lead to blisters or delaminating of additional passes of foam or coating. Over spray can travel long distances and may adhere to objects left unprotected such as windows, buildings and automobiles. Protect anything that should not get foamed.

LIMITATIONS OF USE

Spray foam insulation described in this Application Guide is a combustible material with a maximum continuous service temperature of 180°F (82°C). Spray foam insulation should not be used in direct contact with chimneys, flues, steam pipes, recessed lighting or other heat emitting devices. Consult the listing or label of such materials for clearance to combustibles. A minimum clearance of 3" (76mm) should be maintained when applying around recessed lighting or other heat emitting devices (IRC Section R302.14), and it's important to avoid spraying inside electric outlets or junction boxes. Where factory-built chimneys pass through insulated assemblies, an insulation shield made of steel having a thickness of not less than 0.0187 inch (No 26 gage) shall be installed to provide clearance between the chimney and the insulation. Insulation shields provided as part of a listed chimney system shall be installed in accordance with the chimney manufacturer's installation instructions (IRC Section 1005.8). For applications for spray-applied insulation around ductwork, attic hatches, pull-down stairways, windows, pipes or plumbing see to the applicable code. Properly prep and secure any material or surface that should not get insulated. If in doubt about the substrate temperature or surface conditions, a trial application should be conducted to check foam quality and spray performance. Water on the surface from rain, fog, condensation, etc. will react chemically with the isocyanate, adversely affecting the foam and physical properties, particularly adhesion.

COLD WEATHER PROCESSING

Low temperatures affect the foaming process in two ways.

1. Chemical reactions can be slowed due to reduced exothermic energy within the expanding mass, which could lead to poor cell structure, dripping and voids from slow plastic formation
2. This reduced temperature often leads to reduced yield.

The temperature and type of substrate has a greater influence on the quality of the foam than the temperature of the air because the rate of heat transfer from liquid to air is much slower than the rate from liquid to substrate. If the substrate temperature is too low, or it is a highly conductive material such as metal or concrete, the heat produced by the chemical reaction may be drawn into the substrate so rapidly that plastic formation and cell generation becomes very slow, thus reducing yield. It is not a good practice to use the heated chemicals to warm the surface (flash coat). Instead, if the substrate to be sprayed is too cold to produce proper foam, the substrate should be heated using an indirect-fired heater or the foam should be sprayed on a warmer substrate on a warmer day. No open flame or direct heating is permitted during the spraying process.

THERMAL AND UV PROTECTION

Combustible spray foam insulation must be separated from the living space by a thermal barrier in accordance with applicable codes. This product must not be used when the continuous service temperature of the substrate or foam is above 180°F (82°C). Spray foam must be protected from direct exposure to sunlight; incidental exposure during construction may cause surface discoloration but will not degrade the performance of the foam.

VENTILATION

Ventilate during spray foam application and for a minimum of 24 hours following the application or until no objectionable odor remains. If not adequately ventilated during and shortly after application, the odors can be absorbed in adjacent materials such as fibrous insulation, wood framing and household or stored items. Sheet plastic should be placed over any absorbent material that cannot be removed during the spray and ventilation operation.

CHEMICAL STORAGE

Spray foam insulation's B-side resin is packaged in totes or in closed-head metal drums. A-PMDI is packaged in totes or in closed-head metal drums. Products' B-side resin and A-side isocyanate should be stored within their respective temperature ranges as described in Table 1 below. The storage temperature for containers of chemicals used to make spray foam insulation is very important. Installers storing these chemicals should refer to manufacturer information to confirm proper storage practices. The materials should be kept away from direct sunlight. The transfer pump should be removed and the bungs of the A-PMDI and B-side drum tightly closed after use. B-side resin's shelf life should be respected. See the products' B-side SDS for additional information.

LOCATIONS/APPLICATIONS

HBS offers closed-cell and open-cell spray foam products that can be used as a nonstructural thermal insulating material in some or all Types of construction (Types I, II, III, IV & V) under the IBC, and in dwellings under the IRC. Please refer to the appropriate product ESR evaluation report for the specific Types of construction each product can be used in. Closed-cell spray foam insulation can be used installed inside or outside. Such applications include, but are not limited to, external walls, within wall cavities, floor/ceiling assemblies, attics and crawl spaces when installed in accordance with applicable codes. Open-cell spray foam insulation is only intended to be used indoors and above grade. Its applications include within wall cavities, floor/ceiling assemblies and attics when installed in accordance with applicable codes. Local codes should be consulted regarding appropriate thermal and ignition barriers for use with the product where applicable. For additional information, refer to the products' respective Evaluation Service Reports on Huntsman Building Solutions' website.

UNVENTED CRAWL SPACE APPLICATIONS

HBS spray foam insulation shall be applied directly to the crawl space walls, bands of the floor system and in direct contact with framing materials. Do not use separator sheets between the insulation and the concrete/block masonry wall, as this will provide paths for air leakage around the insulated layer. Building Codes require that exposed earth in an unvented crawl space be covered with a continuous Class I Vapor Retarder to avoid excessive moisture loads in the crawl space. The Class I Vapor retarder shall be sealed or taped, its edges shall extend at least 6" up the crawl space wall and shall be attached and sealed to the wall and spray foam applied overtop to prevent any air leakage. Refer to Figure 2 for typical details.

TERMITE INSPECTION GAP

The use of insulation in "very heavy" termite infestation probability areas shall comply with 2021 IBC Section 2603.8 & 2021 IRC Section R318.4. As such, in areas where the probability of termite infestation is "very heavy", extruded and expanded polystyrene, polyisocyanurate and other foam plastics shall not be installed on the exterior face or under interior or exterior foundation walls or slab foundations located below grade. The clearance between foam plastics installed above grade and exposed earth shall be not less than 6 inches (152mm). Refer to local codes that may require a gap at the top of the foundation walls for termite inspection purposes. The SPF & Pest Management industry developed a solution to maintain building performance and permit visual termite inspection. One solution that provides the inspection gap (no foam) on the top (if required) and 6" gap on the bottom of the foundation wall is not to install spray foam over the band joist and mudsill. In this case, the framing members must be caulked at all the joints between the band joists, floor joists, the floor sheathing above, and to the top of the foundation, as can be seen on Figure 3. A non-rigid removable insulation would then be placed between the joists to insulate the band joist and the mudsill. This will allow for the periodic inspections required to maintain termite warranties/bonds. Moreover, in very heavy termite infestation areas, it is not recommended to install spray foam directly on the soil as it may be an at-risk area that would require access for visual inspection.

Figure 2

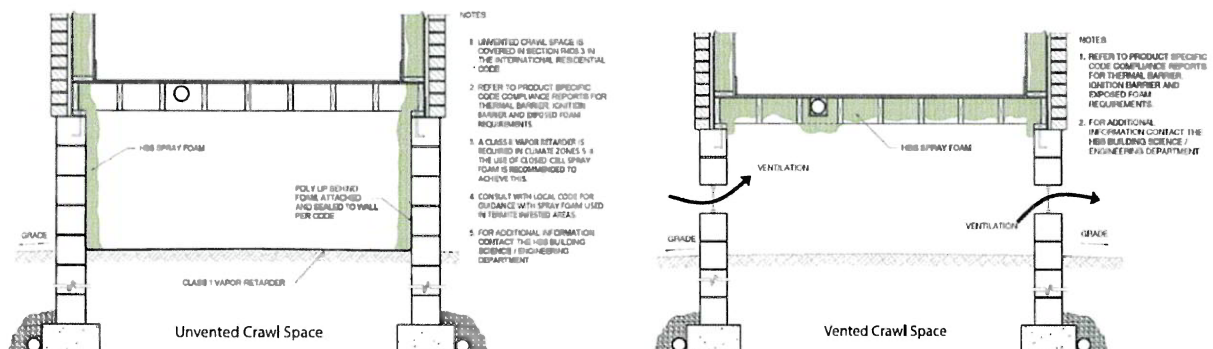
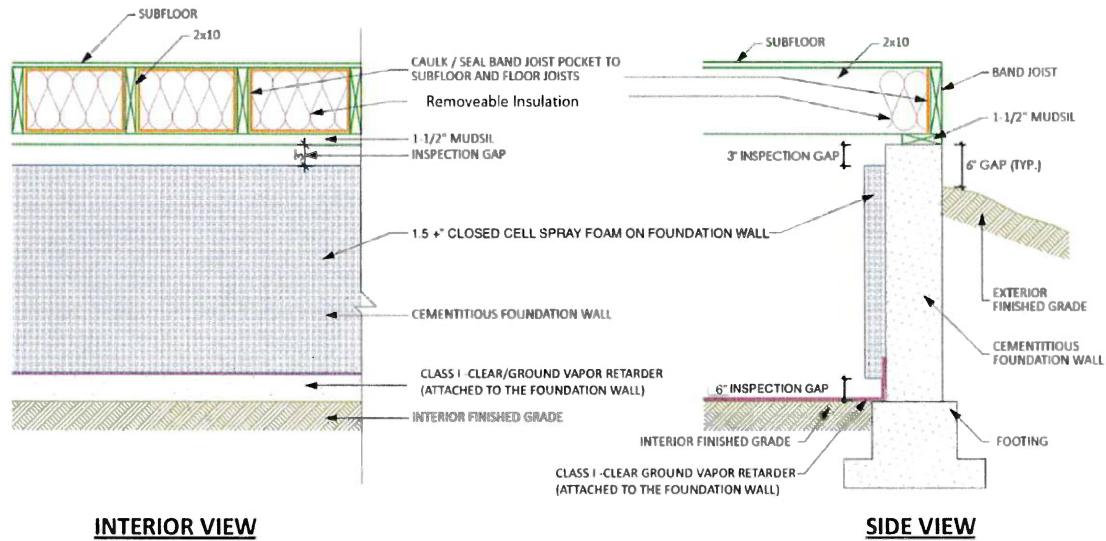


Figure 3 – Unvented/Sealed Crawlspace with 1.5" + Closed-Cell Spray Foam on Foundation Wall and Removable Insulation on Band Joist

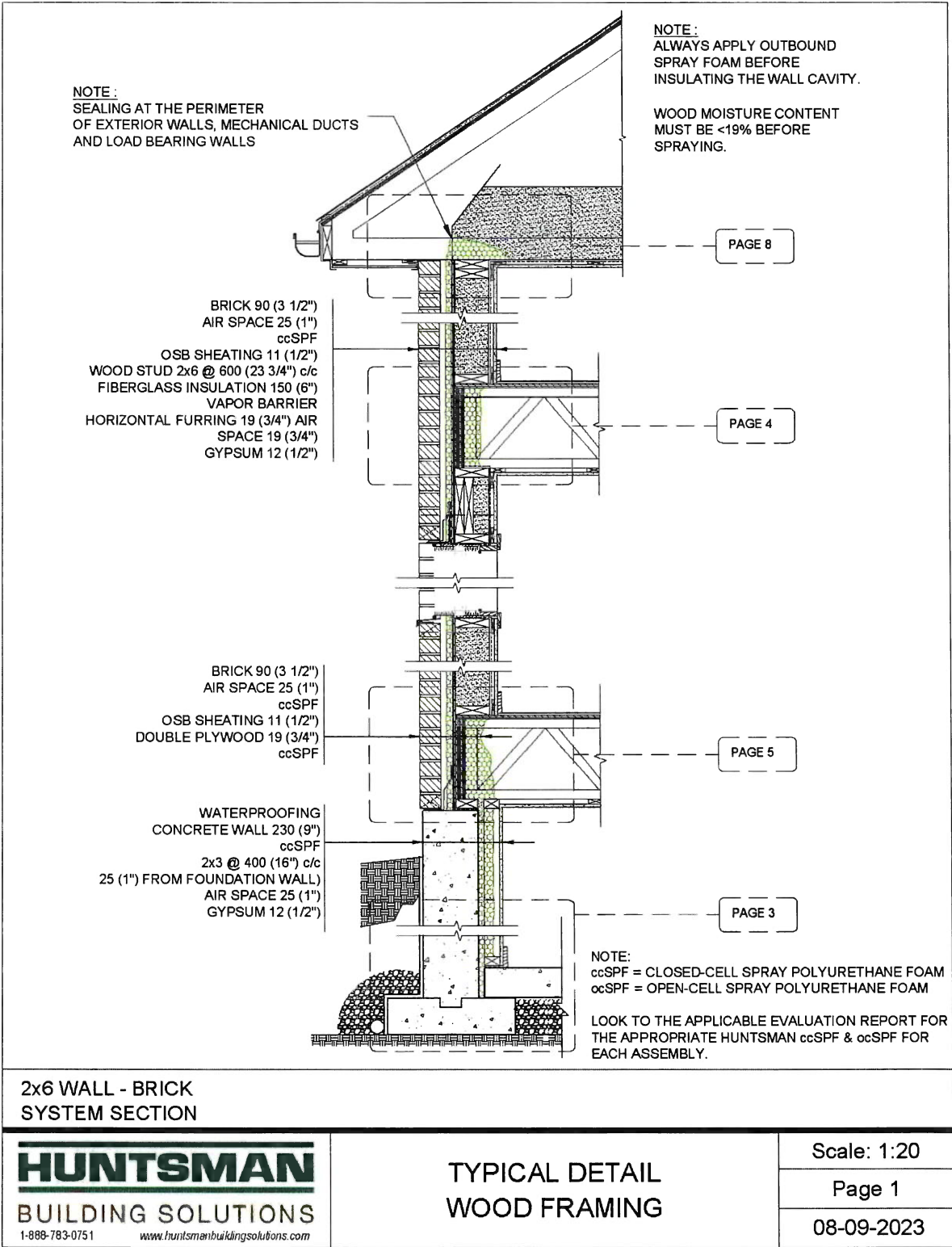
**FOR MORE INFORMATION**

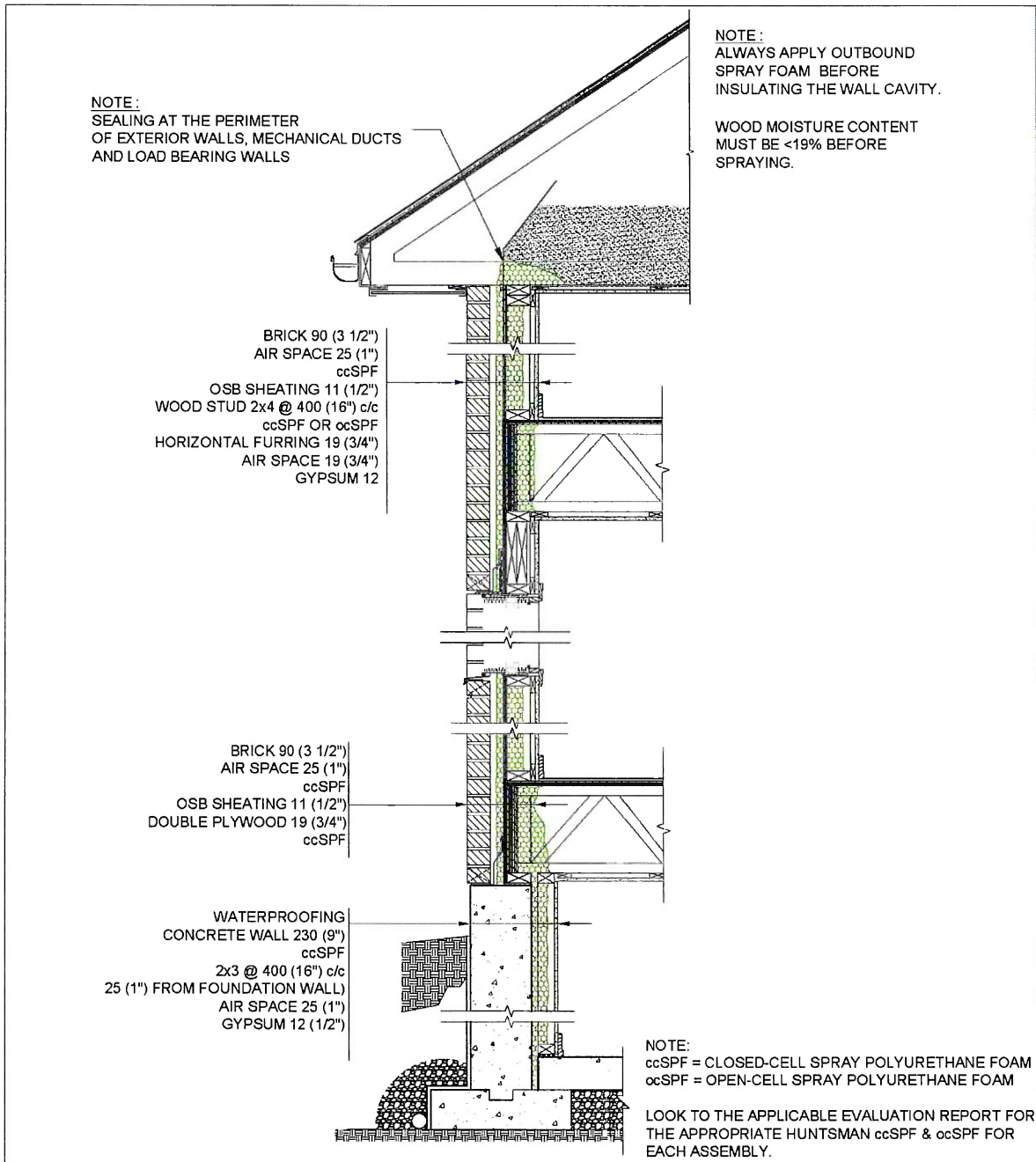
Visit www.huntsmanbuildingsolutions.com or call 817-640-4900 for more information on health, safety and environmental protection with respect to polyurethane chemicals.

Disclaimer: The information herein is to assist customers in determining whether our products are suitable for their applications. We request that customers inspect and test our products before use and satisfy themselves as to contents and suitability. Nothing herein shall constitute a warranty, expressed or implied, including any warranty of merchantability or fitness, nor is protection from any law or patent inferred. All patent rights are reserved. The foam product is combustible and must be protected in accordance with applicable codes. Protect from direct flame and spark contact, around hot work for example. The exclusive remedy for all proven claims is replacement of our materials.

APPENDIX A

Construction drawings representing typical assembly details and locations where spray foam is certified to be used in residential buildings.





2x4 WALL - BRICK
SYSTEM SECTION

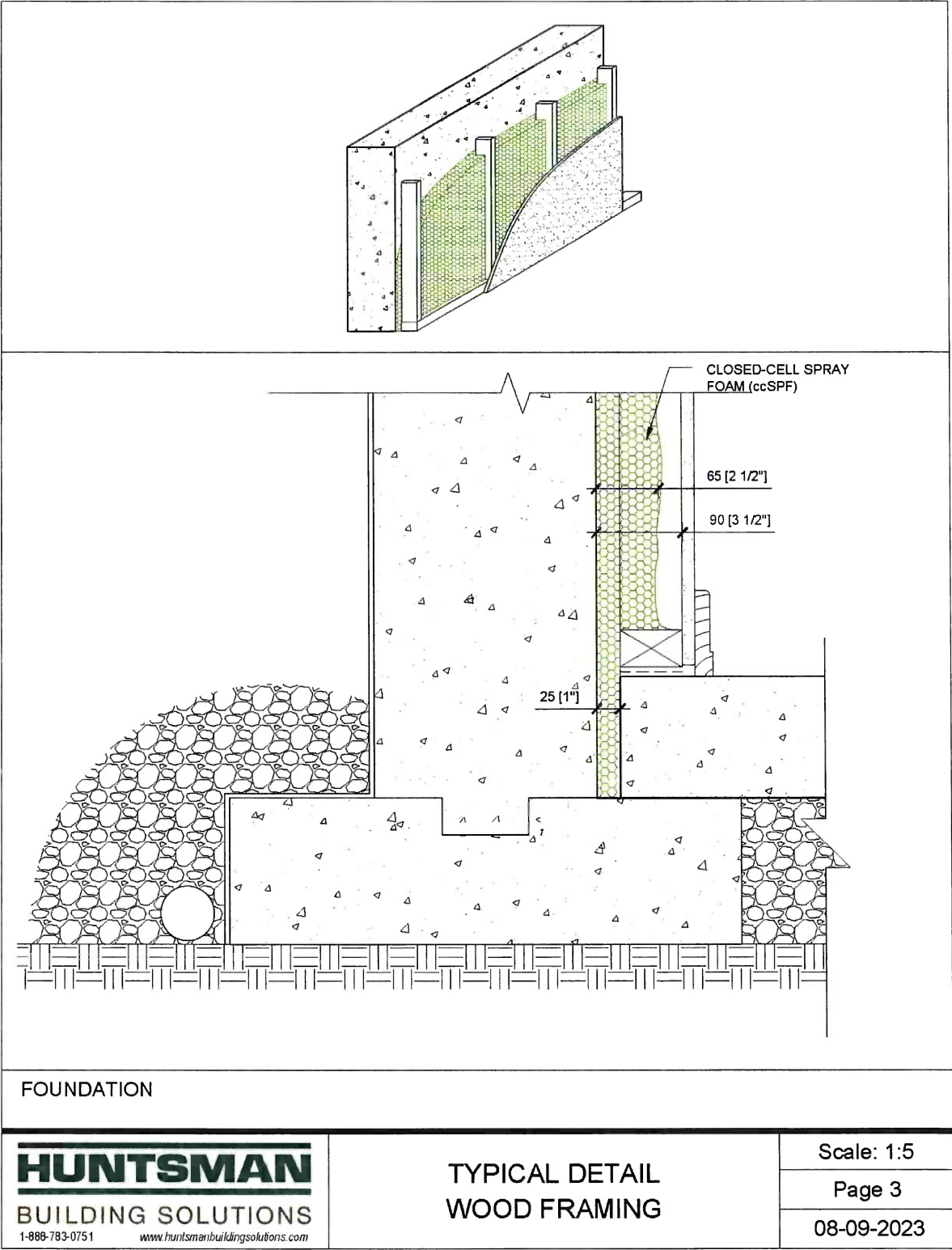
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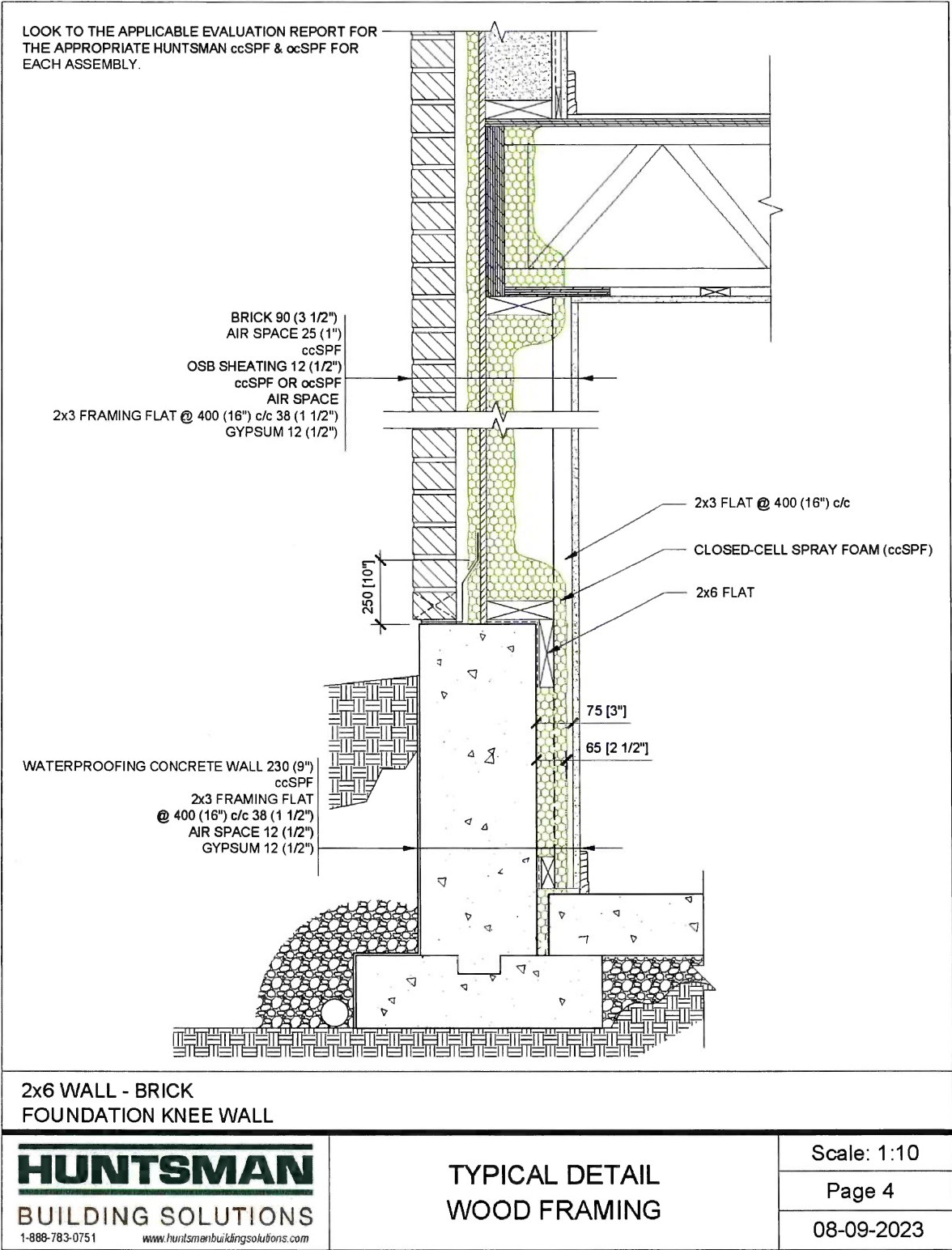
TYPICAL DETAIL
WOOD FRAMING

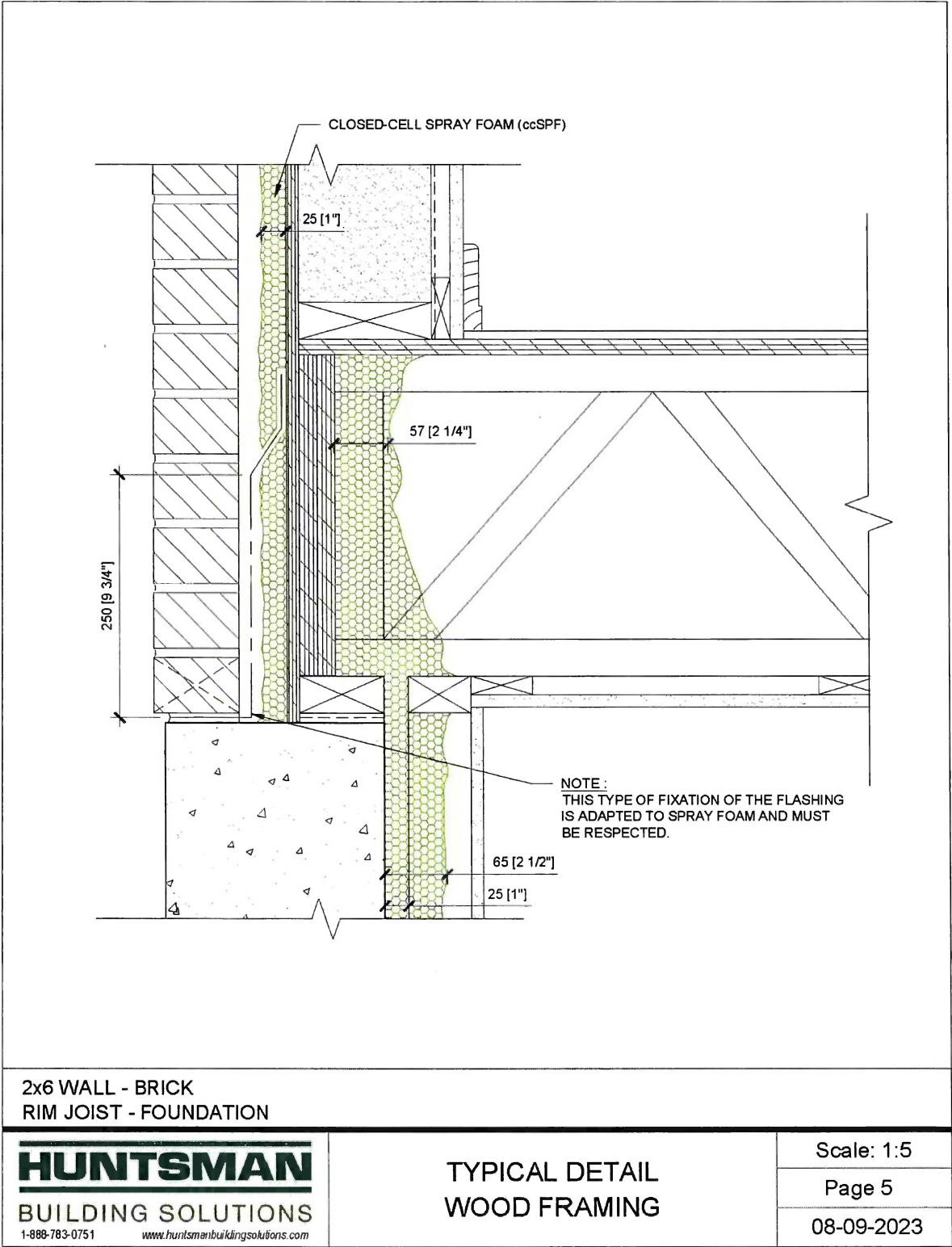
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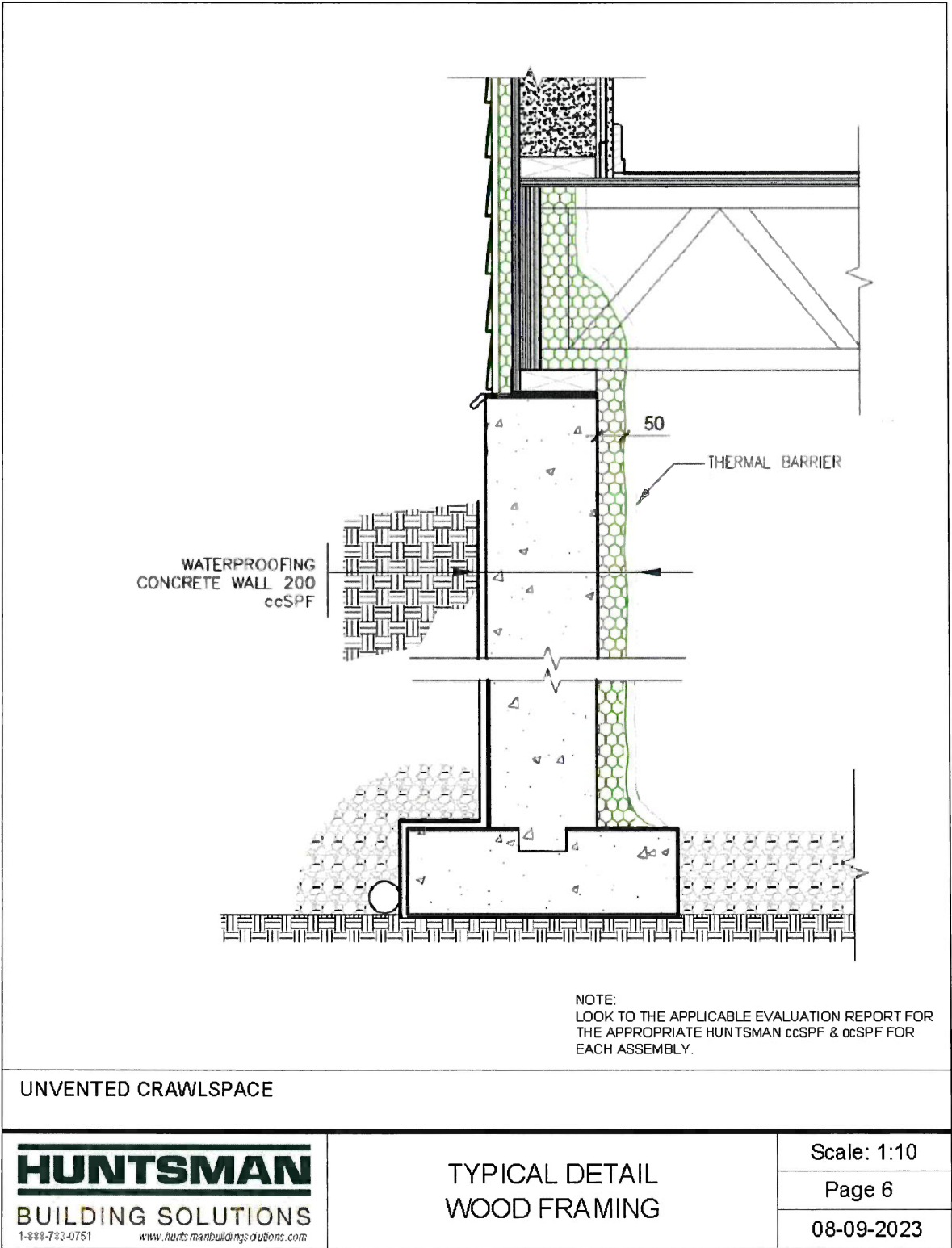
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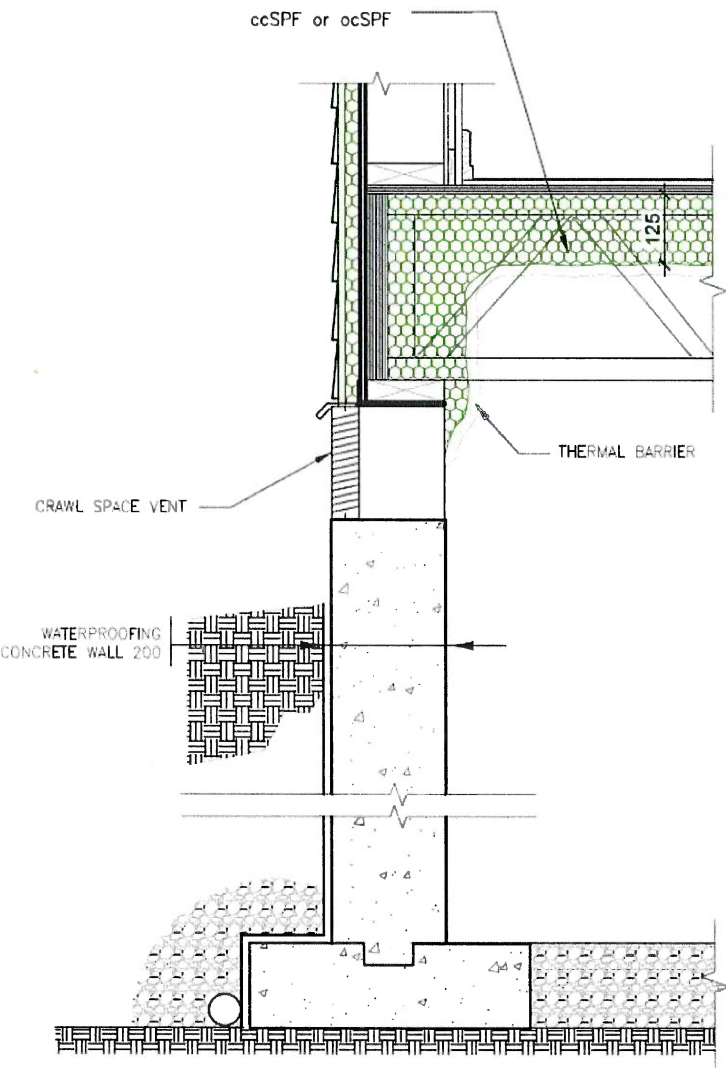






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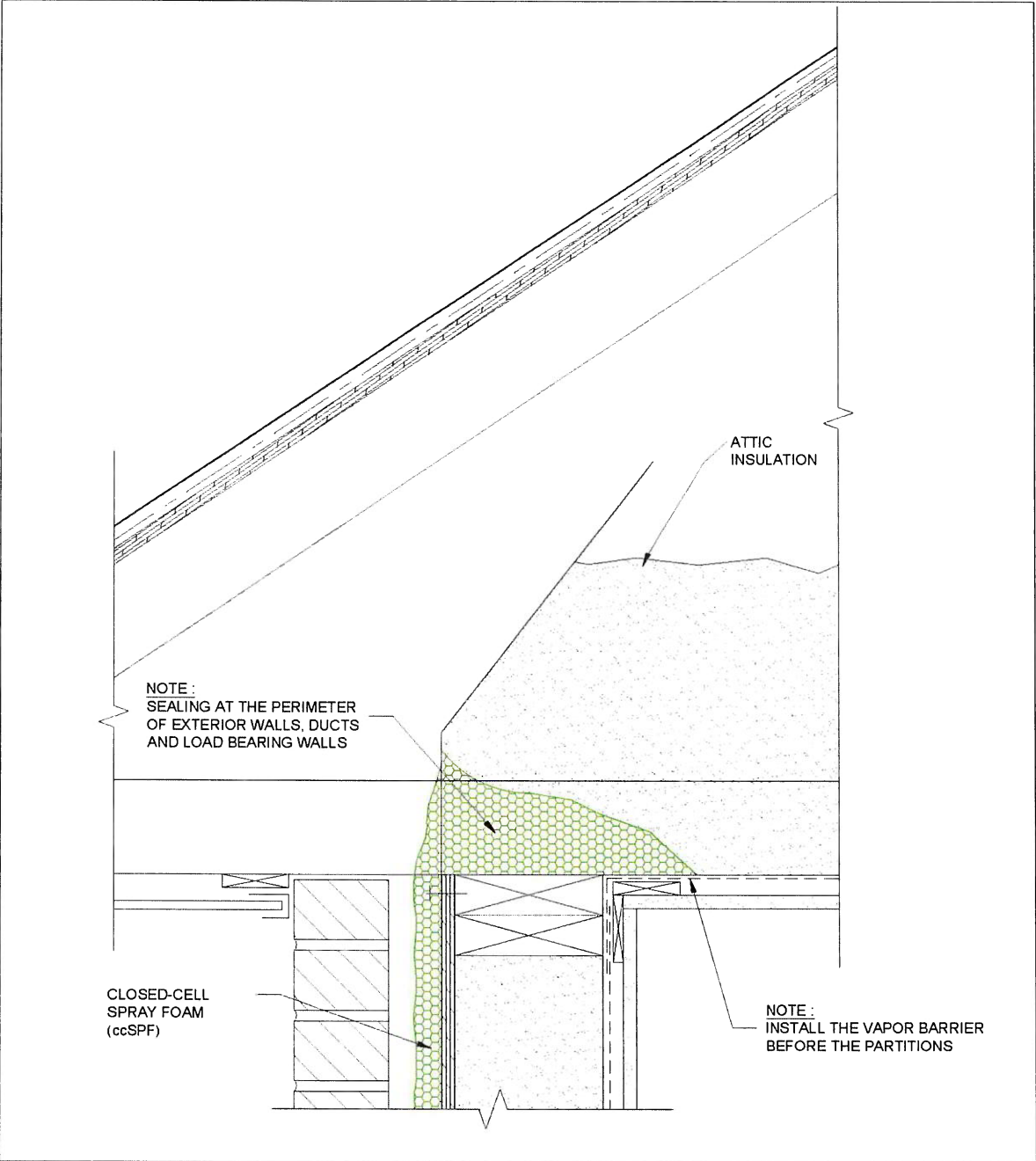
NOTE:
LOOK TO THE APPLICABLE EVALUATION REPORT FOR
THE APPROPRIATE HUNTSMAN ccSPF & ocSPF FOR
EACH ASSEMBLY.

VENTED CRAWLSPACE CEILING

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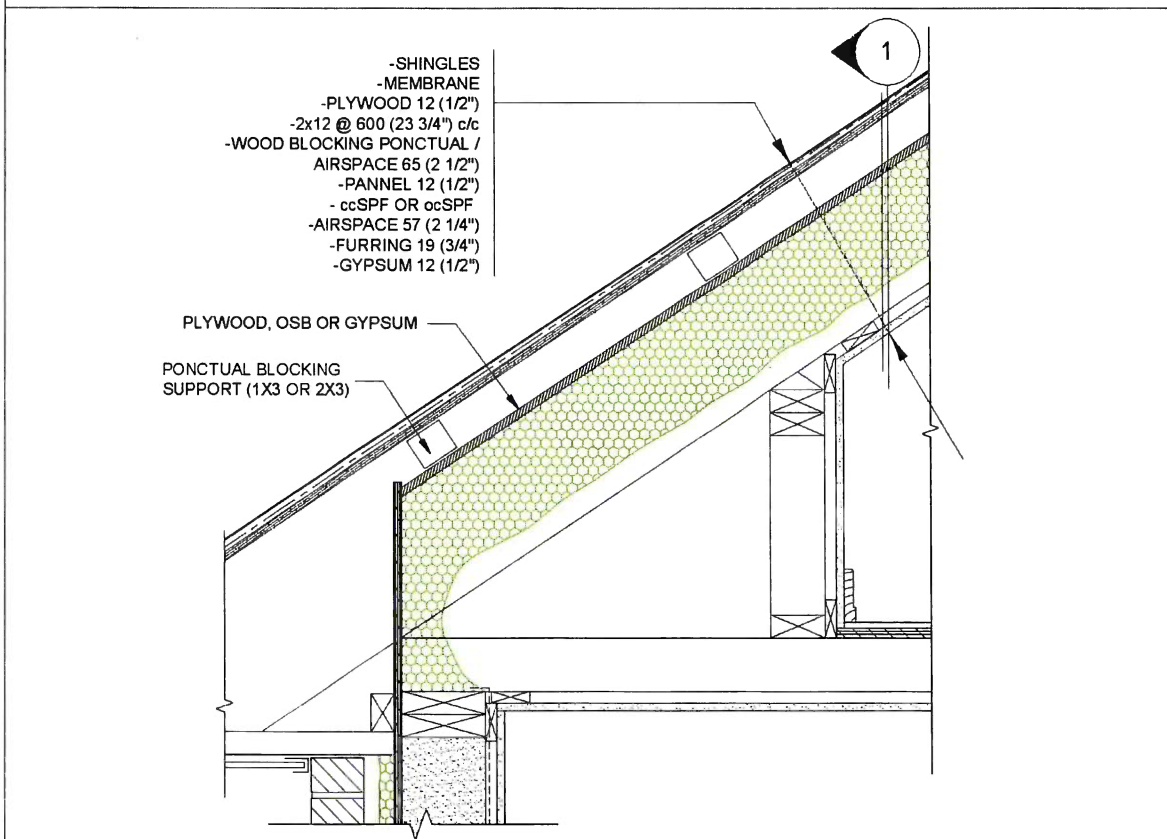
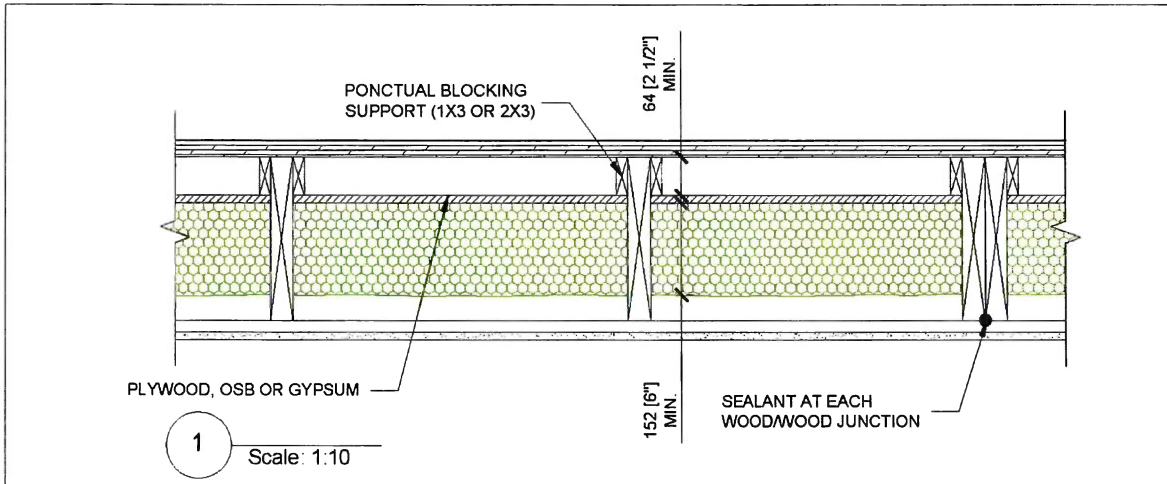
TYPICAL DETAIL
WOOD FRAMING

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2x6 WALL - BRICK
ATTIC JUNCTION

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2x6 WALL - BRICK
CATHEDRAL VENTILATED -KNEE WALL

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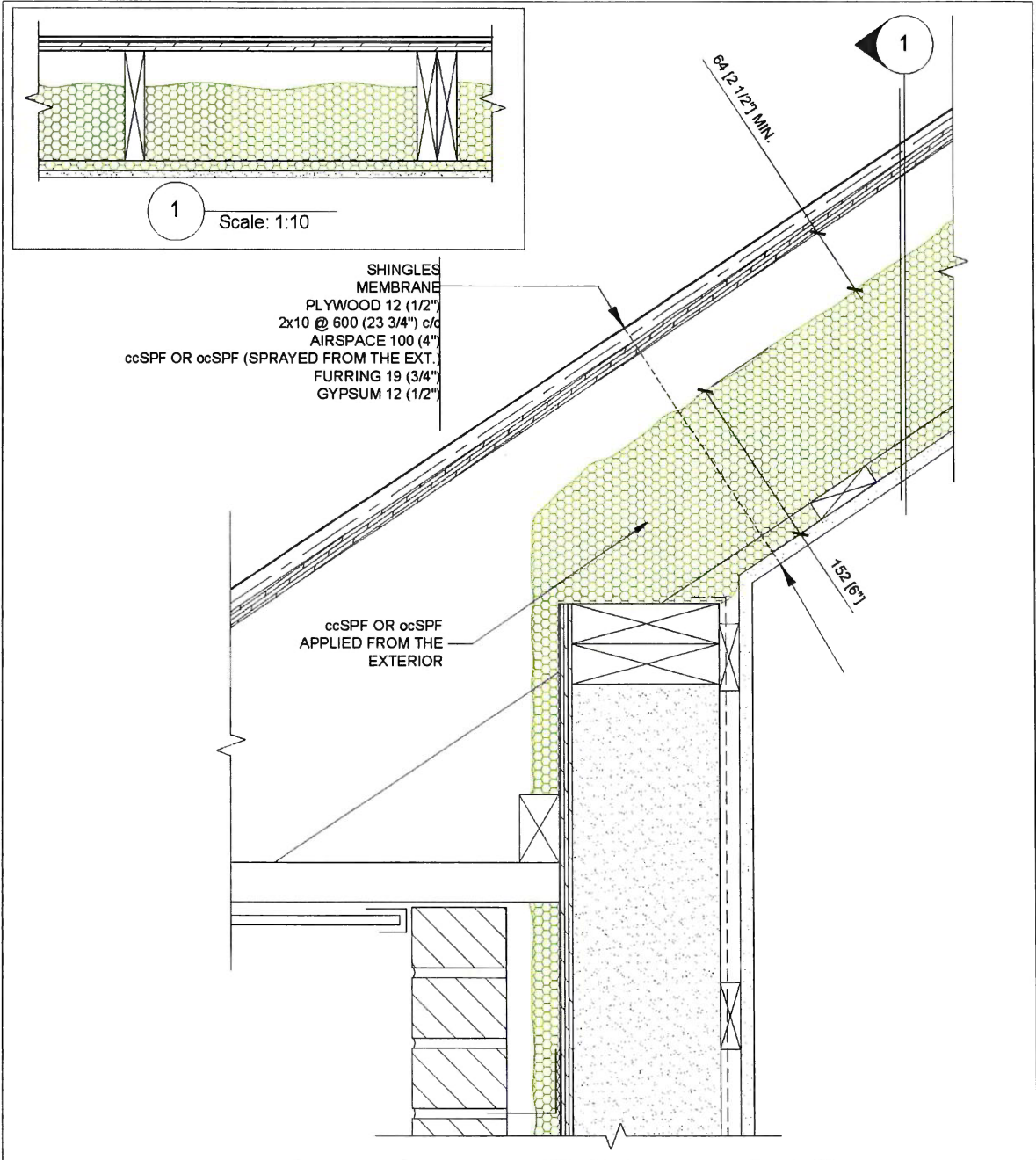
TYPICAL DETAIL
WOOD FRAMING

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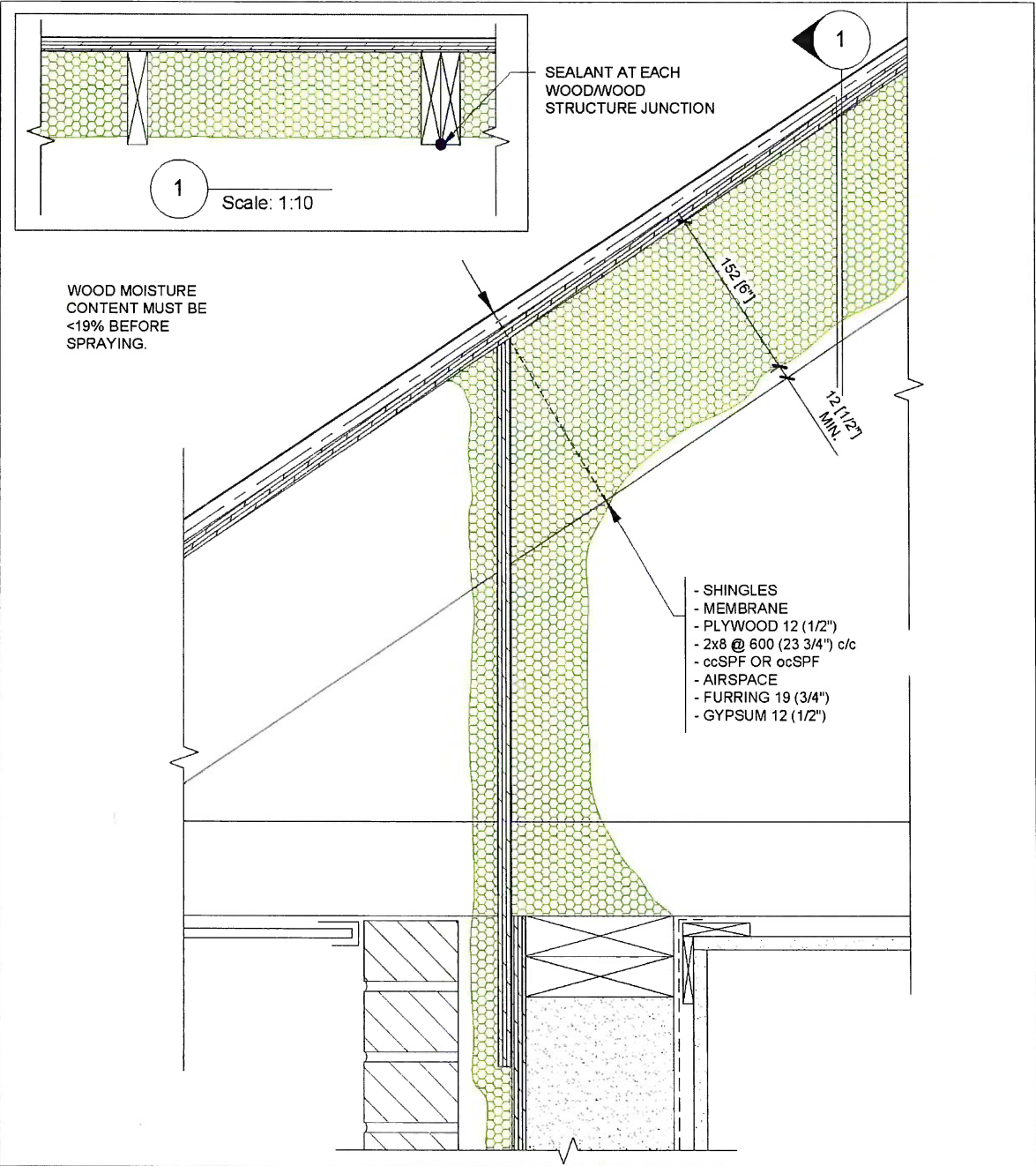
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2x6 WALL - BRICK
VENTILATED CATHEDRAL ROOF EXT.

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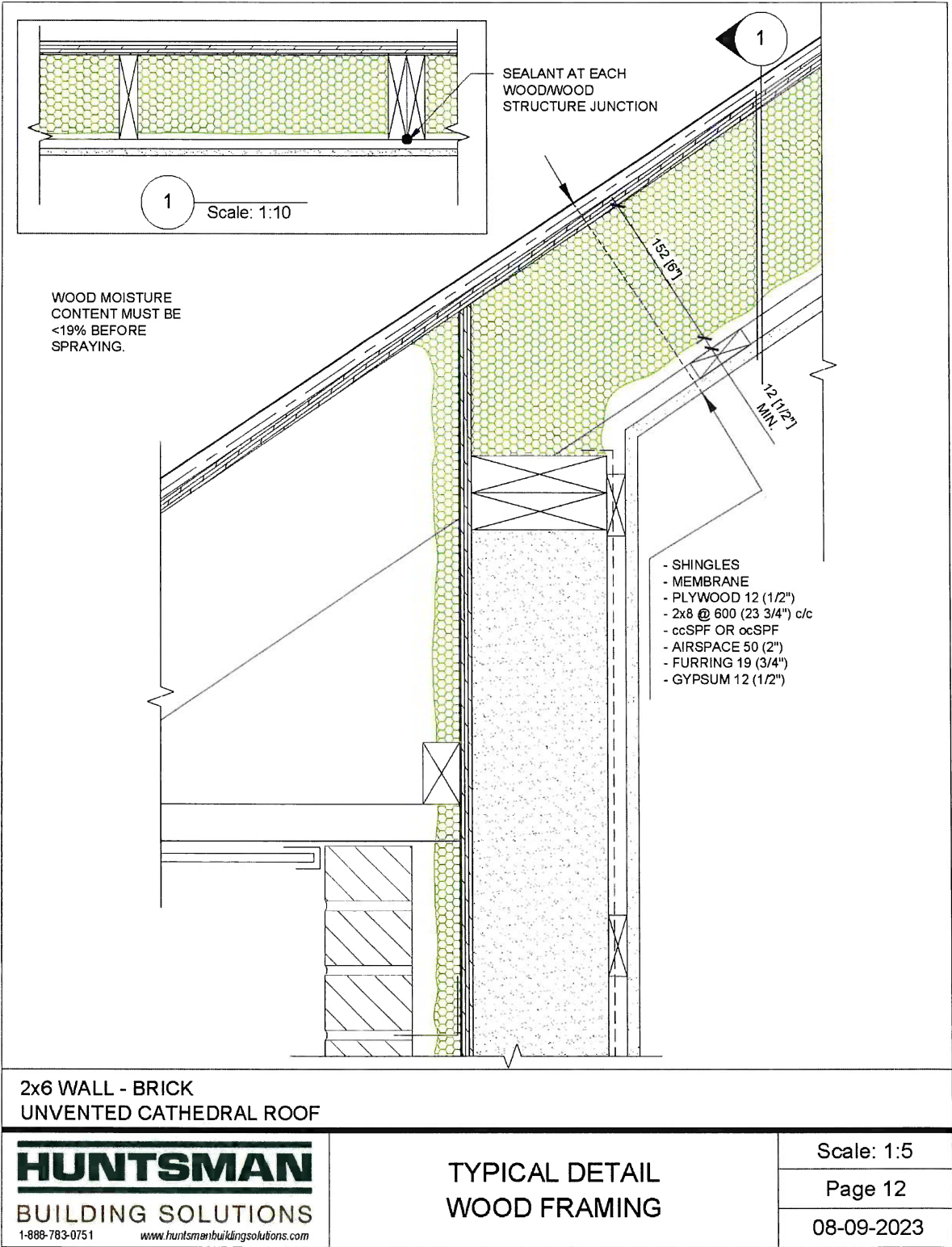
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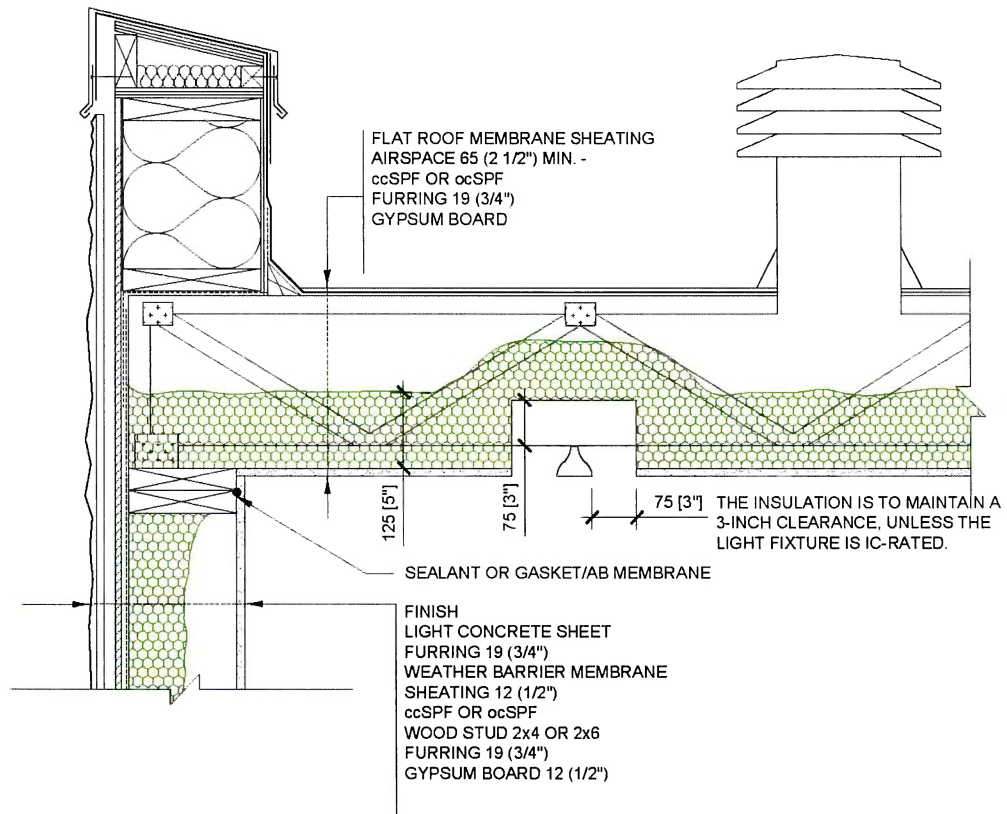


2x6 WALL - BRICK
UNVENTED ROOF

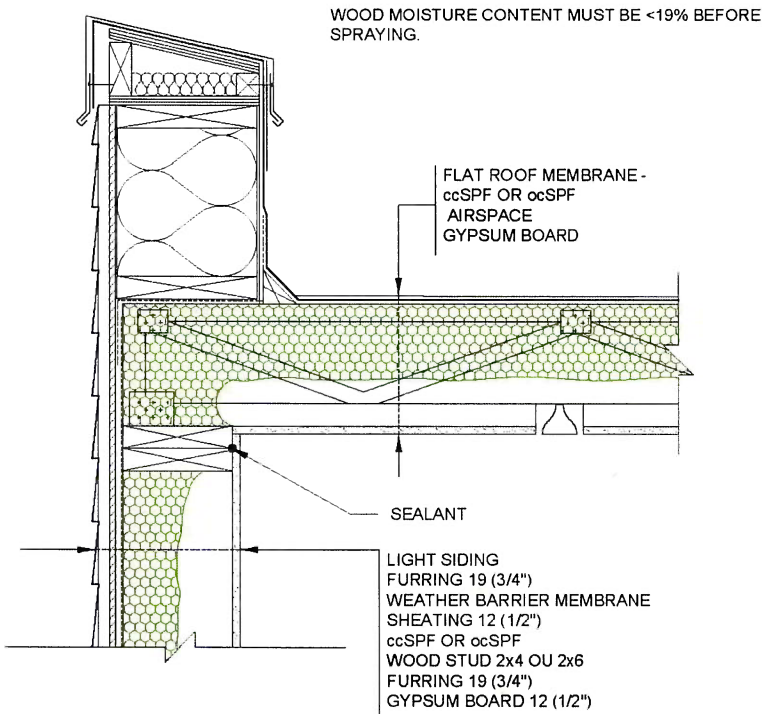
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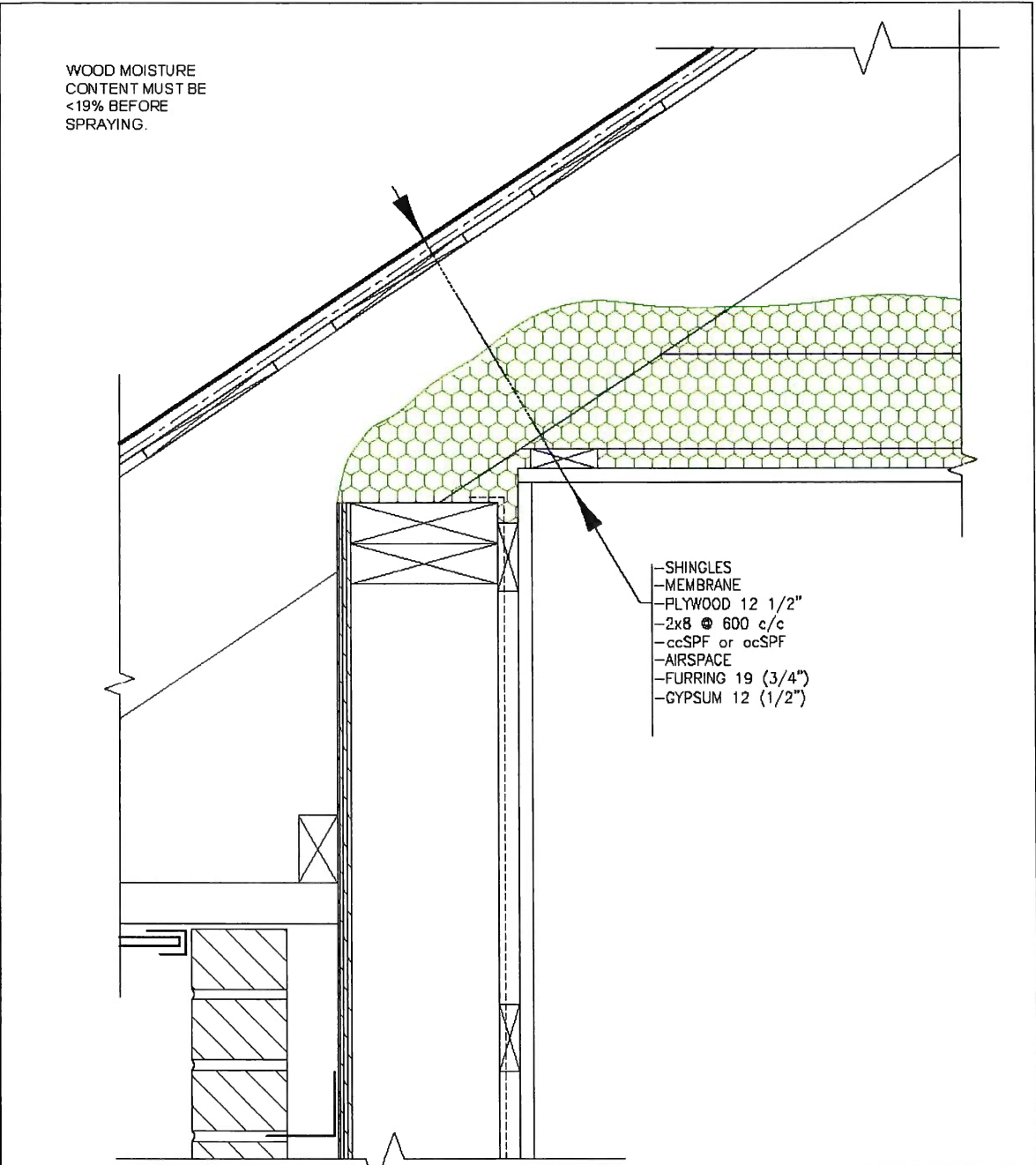
FLAT ROOF - VENTILATED



FLAT ROOF - UNVENTILATED

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INSULATION ON ATTIC FLOOR

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HEATLOK® HFO PRO

TECHNICAL DATA SHEET

Heatlok® HFO Pro is a two component, closed cell, spray applied, rigid polyurethane foam system. This product uses recycled plastic materials, rapidly renewable soy oils, and the blowing agent has zero ozone depleting potential. Heatlok HFO Pro complies with the intent of the International Code Council's residential and commercial building codes and is commonly used as a thermal insulation, air barrier, vapor retarder and water resistive barrier in above grade, below grade, interior and exterior applications.

PHYSICAL PROPERTIES			
ASTM D 1622	Core Density	2.0 lb/ft ³	32.0 kg/m ³
ASTM C 518	Aged Thermal Resistance	1" = 7.4 ft ² h°F/BTU 1" = 1.3 Km ² /W	3.5" = 23 ft ² h°F/BTU 3.5" = 4.04 Km ² /W
ASTM E 283	Air Leakage @ 75 Pa @ 1"	< 0.02 L/sm ²	
ASTM E 2178	Air Permeance @ 75 Pa @ 1"	< 0.02 L/sm ²	
ASTM E 96	Water Vapor Permeance	0.91 perms	52.5 ng/Pa•s•m ²
	Class II vapor retarder per IBC Section 202 @ 1"		
	Class II vapor retarder @ ≤ 1 perm	1"	25.4mm
ASTM D 2842	Water Absorption (volume)	0.3%	
ASTM D 1621	Compressive Strength	31 psi	214 kPa
ASTM D 1623	Tensile Strength	44 psi	303 kPa
ASTM D 2126	Dimensional Stability @ 158°F (70°C) 97% R.H. (168 hours)	-3.7 (% volume change)	
VOC Emissions	UL Environment (Greenguard Gold)	Meets Criteria	
ASTM C 1338	Fungi Resistance	No fungal growth	
ASTM D 2856	Closed Cell Content	98%	
ASTM D 6226	OpenCell Content	9.95%	
ASTM C 1029	Standard specification for spray applied rigid cellular polyurethane thermal insulation	Type II Compliant	

FIRE TEST RESULTS		
ASTM E 84	Surface Burning Characteristics, 4" thick Flame Spread Index Smoke Developed	Class I 12 350 -400
AC 377 Appendix X	Ignition Barrier – Compliant with 2012, 2015, 2018 & 2021 IBC and IRC, and ICC-ES AC-377 Appendix X, for use in attics and crawl spaces without a prescriptive ignition barrier or intumescent coating.	Pass
NFPA 285	Compliant with 2012, 2015, 2018 & 2021 IBC with brick, metal or aluminum cladding for exterior walls of Type I, II, III and IV buildings of any height. See UES 565 Tables for specific assembly requirements. Contact the Huntsman Building Solutions Engineering Department for assistance with alternate assemblies.	Pass
NFPA 286	Thermal Barrier – Compliant with the 2012, 2015, 2018 & 2021 IBC and IRC, as an interior finish without a 15 minute thermal barrier when coated with DC-315 at 18 mils wet film thickness, 12 mils dry film thickness, or No-Burn Plus ThB at 16 mils wet film thickness, 11 mils dry film thickness.	Pass

RECOMMENDED PROCESSING PARAMETERS		
Initial Primary Heater A-Side (ISO) Setpoint**	92 - 106° F	31 - 41° C
Initial Hose Heat Setpoint**	102 - 115° F	39 - 46° C
Initial Primary Heater B-Side (Resin) Setpoint**	98 - 115° F	37 - 46° C
Initial Processing Setpoint Temperature	1200 - 1400 PSI	8274 - 9653 kPa
Substrate & Ambient Temperature	Summer > 50° F Winter > 15° F	Summer > 10°C Winter > -9°C
Moisture Content of Substrate	≤19%	≤19%
Moisture Content of Concrete	Concrete must be cured, dry, and free of dust and form release agents.	

*Foam application temperatures and pressures can vary widely depending on temperature, humidity, elevation, substrate, equipment and other factors. While processing, the applicator must continuously observe the characteristics of the sprayed foam and adjust processing temperatures and pressures to maintain proper cell structure, adhesion, cohesion and general foam quality. It is the sole responsibility of the applicator to process and apply this product within specification.

**It may be necessary to go outside of the recommended processing parameters or split temps due to ambient temps and material viscosity.

RECYCLED & RENEWABLE CONTENT

Recyclable Content	19%
Renewable Content	6%

REACTIVITY PROFILE

Cream Time 0 – 1 seconds	Gel Time 2 seconds	Tack Free Time 3 – 4 seconds	End of Rise 3 – 4 seconds
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LIQUID COMPONENT PROPERTIES

PROPERTY	A-PMDI ISOCYANATE	HEATLOK HFO PRO RESIN
Color	Brown	Blue
Viscosity @ 77°F (25°C)	180 – 220 cps	500 – 800 cps
Specific Gravity	1.24	1.17 – 1.21
Shelf Life of unopened drum properly stored	12 months	6 months
Storage Temperature	50 – 100°F (10 – 38°C)	50 – 70°F (10 – 21°C)
Mixing Ratio (volume)	1:1	1:1

*See SDS for more information.

General Requirements: Equipment must be capable of delivering the proper ratio (1:1 by volume) of polymeric isocyanate (PMDI) and polyol blend at adequate temperatures and spray pressures. Substrate must be at least 5 degrees above dew point, with best processing results when ambient humidity is below 80%. Substrate must also be free of moisture (dew or frost), grease, oil, solvents and other materials that would adversely affect adhesion of the polyurethane foam. Applicators should limit the application of this product to no more than a thickness of 2" (50mm) per pass (after expansion) to avoid fire hazards (including spontaneous combustion) resulting from excessive heat generation. A second 2" (50mm) layer may be applied immediately after the first one has fully risen. Alternatively, a single pass of up to 3" (76mm) may be applied. In either case, if subsequent passes are needed, applicators should wait until the core temperature of the foam has dropped below 100°F to allow any reaction heat to dissipate from the prior applications before attempting to reapply the product.

RECOMMENDED MAXIMUM PASS THICKNESSES

Maximum Pass	3"	76mm
Dual Pass (x" + x")	2" + 2"	50mm + 50mm

Heatlok HFO Pro must be separated from the interior of the building by an approved thermal barrier or an approved finish material equivalent to a thermal barrier in accordance with applicable codes. Heatlok HFO Pro must be sprayed at a minimum thickness of 1" per pass. This product must not be used when the continuous service temperature of the substrate or foam is below -60°F (-51°C) or above 180°F (82°C). Heatlok HFO Pro should not be used to cover flexible ductwork.

Disclaimer: The information herein is to assist customers in determining whether our products are suitable for their applications. We request that customers inspect and test our products before use and satisfy themselves as to contents and suitability. Nothing herein shall constitute a warranty, expressed or implied, including any warranty of merchantability or fitness, nor is protection from any law or patent inferred. All patent rights are reserved. The foam product is combustible and must be protected in accordance with applicable codes. Protect from direct flame and spark contact, around hot work for example. The exclusive remedy for all proven claims is replacement of our materials.



EXTERIOR WALL SYSTEM COMPONENT
IN ACCORDANCE WITH NFPA 285
SEE BUILDING MATERIALS DIRECTORY
ALSO CLASSIFIED IN ACCORDANCE
WITH ASTM D1929
FILE R39899



HEATLOK® HFO PRO

PRODUCT APPLICATION GUIDE

Additional product information can be found on the Huntsman Building Solutions website at www.huntsmanbuildingsolutions.com. Refer to the following documents plus this Product Application Guide to establish processing parameters for varying substrate and climatic conditions:

- Center for Polyurethane Industries, Guidance on Best Practices for the Installation of Spray Polyurethane Foam
- Heatlok HFO Pro Technical Data Sheet
- Heatlok HFO Pro B-side SDS
- A-PMDI SDS

GENERAL PROCESSING GUIDELINE

Heatlok® HFO Pro requires heat from the proportioner to complete the chemical reactions necessary to create foam meeting the specifications on the Technical Data Sheet. Fully functional primary heaters and hose heat are needed to process Heatlok HFO Pro. Please consult the Huntsman Building Solutions Technical Service Department for further assistance.

CHEMICAL CONDITIONING

The chemical drums should be stored and maintained between 50°F (10°C) and 70°F (21°C), before processing at the job site. If the drums are bulged due to excessive heat, do not open the drums. Cool the drums for approximately 24 – 48 hours to allow the reacted blowing agent, Solstice® LBA, to return to a liquid state. Other means of cooling the drums on site may be necessary, contact the Huntsman Building Solutions Technical Service Department for more information.

SUBSTRATE PREPARATION

All surfaces to be sprayed must be free of oil, grease, waxes, rust scale, loose dirt and water. In addition, the substrate must be structurally sound. The moisture content of wood substrates must not exceed 19% before foam is applied. Some metal surfaces may require sandblasting and priming prior to foam spraying to ensure adequate adhesion. Consult a Huntsman Building Solutions Technical Service Representative for additional information on surface preparation. When in doubt about the potential for adhesion to a substrate, build a mock-up and spray the foam under similar conditions to that expected in the field, then test for adhesion and cohesion.

Applying foam insulation to concrete:

- Concrete and masonry must be fully cured and “bone-dry.”
- Oils – wash with detergent and allow to dry
- Salt or calcium deposits – wash with detergent and allow to dry
- Muriatic acid can be an effective cleaning agent for preparing concrete substrates prior to spraying foam. Follow the label instructions for dilution and application.

Applying foam insulation to galvanized steel:

- Oils or passivators – clean with solvent, wash with water based cleaner/degreaser, brush blasting may be necessary.
- Do not use hydrocarbon solvents like mineral spirits to clean galvanized metal.
- White rust – wire brushing or scrubbing with a stiff brush or abrasive pad.
- Prime using a DTM (direct to metal) bonding primer suitable for galvanized metal.

Applying foam over previously painted surface:

- Glossy surfaces – sand or abrade surfaces.

Applying foam over bare steel/metal:

- Rust scales – wire brushing or scrubbing with a stiff brush or abrasive pad.
- Corrosion – clean then prime with suitable bonding primer.
- Glossy or very smooth surfaces – sand or abrade surfaces.

Applying foam over stainless steel:

- Oils – wash with mineral spirits and then prime with a suitable primer. Brush blasting, sanding or abrading may be necessary as foam requires a mechanical bond.

Applying foam over aluminum:

- Oils, Hydrated Alumina – clean with solvent, never use a caustic solution, and prime with a high adhesion bonding primer suitable for aluminum.

Applying foam over glass:

- Oils – wash with detergent
- Glossy or very smooth surfaces – sand or abrade surfaces.
- UV degradation – prime glass surface with suitable primer.

Asphalt and Tar:

- Solvents – allow to cure and for solvent to evaporate, prime with suitable primer.

Rigid Polyurethane Foam:

- UV degradation – remove surface of foam with wire brush or wire grinding wheel.

Polypropylene, polyethylene, some silicones and some ceramic surfaces:

- Heatlok HFO Pro may not adhere without a mechanical attachment to these substrates.

APPLICATION PARAMETERS

EQUIPMENT – Follow the spray equipment manufacturer's safe operation guidelines. Every spray unit is slightly different and you will need to adjust your primary heater and hose temperatures accordingly for each polyurethane foam system. Adjust your processing pressures and application technique for an appropriate spray pattern for the substrate and structure.

PROPORTIONER – Use only fixed ratio (one-to-one), volumetric positive displacement pumps connected to a common drive or gear driven systems insuring a one-to-one ratio.

RATIO ASSURANCE TYPE SOFTWARES – Huntsman Building Solutions concurs with allowing a setting of a maximum ratio variance of 5%. Any deviance from that should be addressed immediately before continuing the installation. It should be noted that such tools and information are merely aids to spray foam contractors. *

TRANSFER PUMPS – Use 2:1 or 1:1 double acting transfer pumps assuring equal pressure is delivered from both sides to the proportioner. Diaphragm pumps, wall mounted or drum mounted pumps should not be used to process 2 lb foams containing the blowing agent Solstice LBA. Contact the Huntsman Building Solutions Technical Service Department for recommendations.

PRIMARY HEATERS – The primary heaters should be resistance controlled, direct contact heating rods, either submersible, mass block and tube style or combination of direct heating contact rods and mass block (hybrid heater). The primary heaters should be controlled through independent controllers, separated from the hose heat to ensure an accurate setpoint temperature. Heatlok may not be consistently sprayed in conformance with the written specification if the combination of the proportioner's pumping capacity, the primary heat capability and spray gun discharge rate (mixing chamber size) is out of balance. Contact the Huntsman Building Solutions Technical Service Department for further guidance.

HEATED HOSE – Huntsman Building Solutions recommends the use of heated spray hoses rated at ≥ 2000 psi. Use moisture resistant hoses specifically designed for isocyanate. The heated spray hose should be able to maintain temperatures up to 190°F (88°C) and should be heated using an electrical element with an independent temperature sensor. The heated hose should also be adjusted and monitored separately from the A and B primary heaters, and should be capable of maintaining the temperature from the A and B primary heaters all the way to the spray gun.

FLUSHING/CHANGING FROM ANOTHER CHEMICAL TO HEATLOK HFO PRO

Follow the published flushing procedure on the Huntsman Building Solutions website. Never flush water through the A-side (iso side). Failure to properly flush will result in off-spec foam and does not comply with the ICC Evaluation Service Report and does not qualify for the Huntsman Building Solutions Limited Lifetime Warranty.

FOAM APPLICATION

In preparation for spraying, an off-target test spray should be performed to verify the processing pressure, primary heater and hose temperature settings. The "initial setpoint temperatures" listed below and on the Technical Data Sheet are suggested general starting parameters; it's important to observe the foam and the reaction time of the reacting mass and make additional adjustments throughout the day as needed to maintain proper cell structure, adhesion, cohesion and general foam quality.

RECOMMENDED PROCESSING CONDITIONS*		
Initial Primary Heater Setpoint Temperature	105 – 115°F	41 – 46°C
Initial Hose Heat Setpoint Temperature	105 – 115°F	41 – 46°C
Initial Processing Setpoint Pressure	1200 – 1400 psi	8274 – 9653 kPa
Substrate & Ambient Temperature	Summer > 50°F Winter > 15°F	Summer > 10°C Winter > -9°C
Moisture Content of Substrate	$\leq 19\%$	$\leq 19\%$
Moisture Content of Concrete	Concrete must be cured, dry and free of dust and form release agents.	

*Foam application temperatures and pressures can vary widely depending on temperature, humidity, elevation, substrate, equipment and other factors. While processing, the applicator must continuously observe the characteristics of the sprayed foam and adjust processing temperatures and pressures to maintain proper cell structure, adhesion, cohesion and general foam quality. It is the sole responsibility of the applicator to process and apply this product within specification.

One proven method of applying Heatlok HFO Pro is to spray perpendicular (90 degree angle) to the substrate, holding the gun 18 – 24" away from the substrate. This technique also helps minimize over spray. Heatlok HFO Pro should be applied by spraying vertically or horizontally to the substrate while overlapping the passes 60 – 80%. Apply by spraying into the gelling material (wet line) as it is rising. If the processing parameters are set too high, the pattern may be uncontrollable, the mixing chamber may clog often, the wet line will not be as pronounced and the surface characteristics will be rough. When the parameters are too low the foam may spray in a direct stream and remain un-reacted for several seconds.

Always spray perpendicular to the surface in 1" to 3" lifts. Applicators should limit the application of this product to no more than a thickness of 2" (50mm) per pass (after expansion) to avoid fire hazards (including spontaneous combustion) resulting from excessive heat generation. A second 2" (50mm) layer may be applied immediately after the first one has fully risen. If subsequent passes are needed, applicators should wait until the core temperature of the foam has dropped below 100°F to allow any reaction heat to dissipate from the prior applications before attempting to reapply the product. It is recommended to use a 0 – 220°F pocket sized, self-penetrating thermometer to ensure that the foam has cooled before additional layers can be applied. Spraying sections too thick, too fast may result in charring of the foam, or in extreme conditions a fire may result. Thin foam layers often result in poor physical properties, reduced coverage and poor chemical reaction due to low exothermic heat generated from the chemical reaction, which is needed to create proper closed cell formation. When multiple layers are necessary to achieve the proper R-value, cross-hatching should be done. This technique aids in proper cohesion of passes.

The temperature of the substrate has a major effect on the foam density and adhesion. Certain compromises are necessary to spray in cold weather. The "COLD WEATHER PROCESSING" section offers more information on this topic. If in doubt about the substrate or the ambient conditions, a trial application should be done to check foam quality and spray performance. Water on the substrate from rain, fog, condensation, etc. will react chemically with the isocyanate, adversely affecting the physical properties, performance and adhesion of the foam. Heatlok should never be applied when the relative humidity is above 80%, as high relative humidity can adversely affect the physical properties of the foam.

EXTERIOR FOAM APPLICATION

Climatic conditions are an important factor that should be considered when preparing to apply foam to the exterior of a structure. Ambient and substrate temperatures should be monitored. Foam should only be applied when ambient and substrate temperatures are inside the range for the foam system being used. Foam should only be applied to substrates with less than 19% moisture content. It is best to apply foam when the humidity is less than 80% and the wind is less than 10 mph to maintain proper adhesion. Pay close attention to the temperature of the substrate when applying foam to the exterior of a structure.

Use windscreens downwind, the foam can travel long distances because the particles may separate when airborne. Windscreens can also be configured around scaffolding and man-lifts. It may also be necessary to enclose and preheat the area to the acceptable temperature range for the foam system being used. In preparation for spraying, a test spray should be performed to ensure that the proper processing temperatures and pressures are set. The specified settings per the TDS are general starting parameters, it is important to observe the foam and the reaction time of the reacting mass and make additional adjustments as needed.

Always spray perpendicular to the surface in 1" to 3" lifts. Applicators should limit the application of this product to no more than a thickness of 2" (50mm) per pass (after expansion) to avoid fire hazards (including spontaneous combustion) resulting from excessive heat generation. A second 2" (50mm) layer may be applied immediately after the first one has fully risen. If subsequent passes are needed, applicators should wait until the core temperature of the foam has dropped below 100°F to allow any reaction heat to dissipate from the prior applications before attempting to reapply the product. It is recommended to use a 0 – 220°F pocket sized, self-penetrating thermometer to ensure that the foam has cooled before additional layers can be applied. Spraying sections too thick, too fast may result in charring of the foam, or in extreme conditions a fire may result. Thin foam layers often result in poor physical properties, reduced coverage and poor chemical reaction due to low exothermic heat generated from the chemical reaction, which is needed to create proper closed cell formation. When multiple layers are necessary to achieve the proper R-value, cross-hatching should be done. This technique aids in proper cohesion of passes. Successive passes should overlap 60 – 80% to ensure a smooth surface free of ridges. The thickness of the insulation should be measured with a depth gauge. A final pass should be applied to cover the holes made by the depth gauge and thermometer.

RECOMMENDED MAXIMUM PASS THICKNESS		
Maximum Pas	3"	76mm
Dual Pass (x" + x")	2" x 2"	50mm + 50mm

COLD STORAGE APPLICATIONS

Cold storage facilities require vapor barriers. Vapor barriers are typically applied to the warm side of the insulation system. Heatlok HFO Pro applied at a thickness of or greater than 1.25" is classed as a vapor barrier. Use 1" (25mm) lift passes, thicker passes in deep freezers can lead to severe cracking. Freezers require 2 lb foam, using lower density foam or an over catalyzed foam can also lead to severe cracking. Proper surface preparation may be necessary prior to the application of Heatlok in cold storage applications. Contact the Huntsman Building Solutions Technical Service Department for more information about cold storage applications.

Materials used to construct refrigerated rooms are affected by temperature changes, like all common building materials. Gradual lowering of the temperature is designed to eliminate problems stemming from these temperature changes while at the same time withdrawing construction moisture, and testing the vapor barrier and mechanical system.

COLD STORAGE FACILITY COOL DOWN SCHEDULE

TIME PERIOD	MAX. TEMP. REDUCTION	MIN. ROOM TEMP.
First 24 hours	–	75°F (24°C)
Second 24 hours	15°F (-9°C)	60°F (16°C)
Third 24 hours	15°F (-9°C)	45°F (7°C)
Fourth 24 hours	10°F (-12°C)	35°F (2°C)
Until room is dry (watch moisture on coils as an indicator)	0°F (-18°C)	35°F (2°C)

TEMPERATURE REDUCTION AFTER ATTAINING DRY STATE

TIME PERIOD	MAX. TEMP. REDUCTION	MIN. ROOM TEMP.
First 24 hours	5°F (-15°C)	30°F (-1°C)
Second 24 hours	10°F (-12°C)	20°F (-7°C)
Third 24 hours	10°F (-12°C)	10°F (-12°C)
Fourth 24 hours	10°F (-12°C)	0°F (-18°C)
Fifth 24 hours	10°F (-12°C)	-10°F (-23°C)

HOW TO AVOID OVER SPRAY

Over spray with closed cell foams occurs for a variety of reasons such as spraying the product too cool, applying the product to a substrate that is too cold, not spraying perpendicular to the surface, and high wind conditions. Flash coating to warm the surface is not a recommended practice and may create unwanted over spray. Flash coats are very thin and may not have enough exothermic reaction present to properly cure. Excessive over spray may lead to blisters or delaminating of additional passes of foam or coating. Over spray can travel long distances and may adhere to objects left unprotected such as windows, buildings and automobiles. Protect anything that should not get foamed.

LIMITATIONS OF USE

Heatlok HFO Pro is a combustible material with a maximum continuous service temperature of 180°F (82°C). Heatlok HFO Pro should not be used in direct contact with chimneys, flues, steam pipes, recessed lighting or heat emitting devices. Consult the listing or label of such materials for clearance to combustibles. A minimum clearance of 3" (76mm) should be maintained when applying around recessed lighting, and it's important to avoid spraying inside electric outlets or junction boxes. Properly prep and secure any material or surface that should not get insulated. If in doubt about the substrate temperature or surface conditions, a trial application should be conducted to check foam quality and spray performance. Water on the surface from rain, fog, condensation, etc. will react chemically with the isocyanate, adversely affecting the foam and physical properties, particularly adhesion.

COLD WEATHER PROCESSING

Heatlok HFO Pro can be used down to 15°F (-9°C).

Low temperatures affect the foaming process in two ways.

1. Chemical reactions can be slowed due to reduced exothermic energy within the expanding mass, which could lead to poor cell structure, dripping and voids from slow plastic formation
2. This reduced temperature often leads to reduced yield.

The temperature and type of substrate has a greater influence on the quality of the foam than the temperature of the air because the rate of heat transfer from liquid to air is much slower than the rate from liquid to substrate. If the substrate temperature is too low, or it is a highly conductive material such as metal or concrete, the heat produced by the chemical reaction may be drawn into the substrate so rapidly that plastic formation and cell generation becomes very slow, thus reducing yield. It is not a good practice to use the heated chemicals to warm the surface (flash coat). Instead, if the substrate to be sprayed is too cold to produce proper foam, the substrate should be heated using an indirect-fired heater or the foam should be sprayed on a warmer substrate on a warmer day. No open flame or direct heating is permitted during the spraying process.

THERMAL AND UV PROTECTION

Like all foam plastics, Heatlok HFO Pro must be separated from the living space by a 15 minute thermal barrier in accordance with applicable codes. This product must not be used when the continuous service temperature of the substrate or foam is below -60°F (-51°C) or above 180°F (82°C). Heatlok HFO Pro must be protected from direct exposure to sunlight; incidental exposure during construction may cause surface discoloration but will not degrade the performance of the foam.

VENTILATION

Ventilate during spray foam application and for a minimum of 24 hours following the application or until no objectionable odor remains. If not adequately ventilated during and shortly after application, the odors can be absorbed in adjacent materials such as fibrous insulation, wood framing and household or stored items. Sheet plastic should be placed over any absorbent material that cannot be removed during the spray and ventilation operation.

CHEMICAL STORAGE

Heatlok HFO Pro B-side resin is packaged in totes or in closed-head metal drums. A-PMDI is packaged in totes or in closed-head metal drums. Store the B-side resin at temperatures between 50°F (10°C) and 70°F (21°C). Store the A-side isocyanate at temperatures between 50°F (10°C) and 100°F (38°C). Keep away from direct sunlight. Remove the transfer pump and tightly close the bungs of the A-PMDI and B-side drum after use. Heatlok HFO Pro B-side resin has a 6 month shelf life when stored within the acceptable storage temperatures and the drum is in its original condition with the bungs having never been removed. See Heatlok HFO Pro B-side SDS for additional product information.

FOR MORE INFORMATION

Visit www.huntsmanbuildingsolutions.com or call 817-640-4900 for more information on health, safety and environmental protection with respect to polyurethane chemicals.

Disclaimer: The information herein is to assist customers in determining whether our products are suitable for their applications. We request that customers inspect and test our products before use and satisfy themselves as to contents and suitability. Nothing herein shall constitute a warranty, expressed or implied, including any warranty of merchantability or fitness, nor is protection from any law or patent inferred. All patent rights are reserved. The foam product is combustible and must be protected in accordance with applicable codes. Protect from direct flame and spark contact, around hot work for example. The exclusive remedy for all proven claims is replacement of our materials.

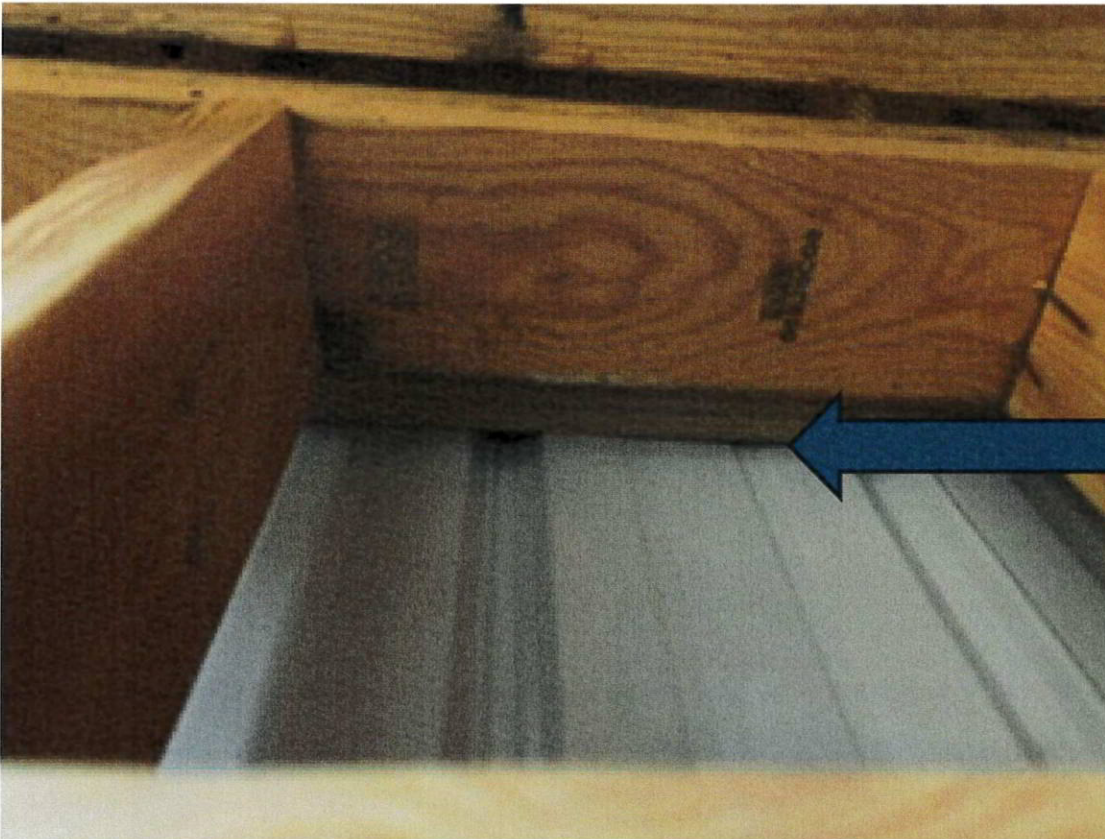
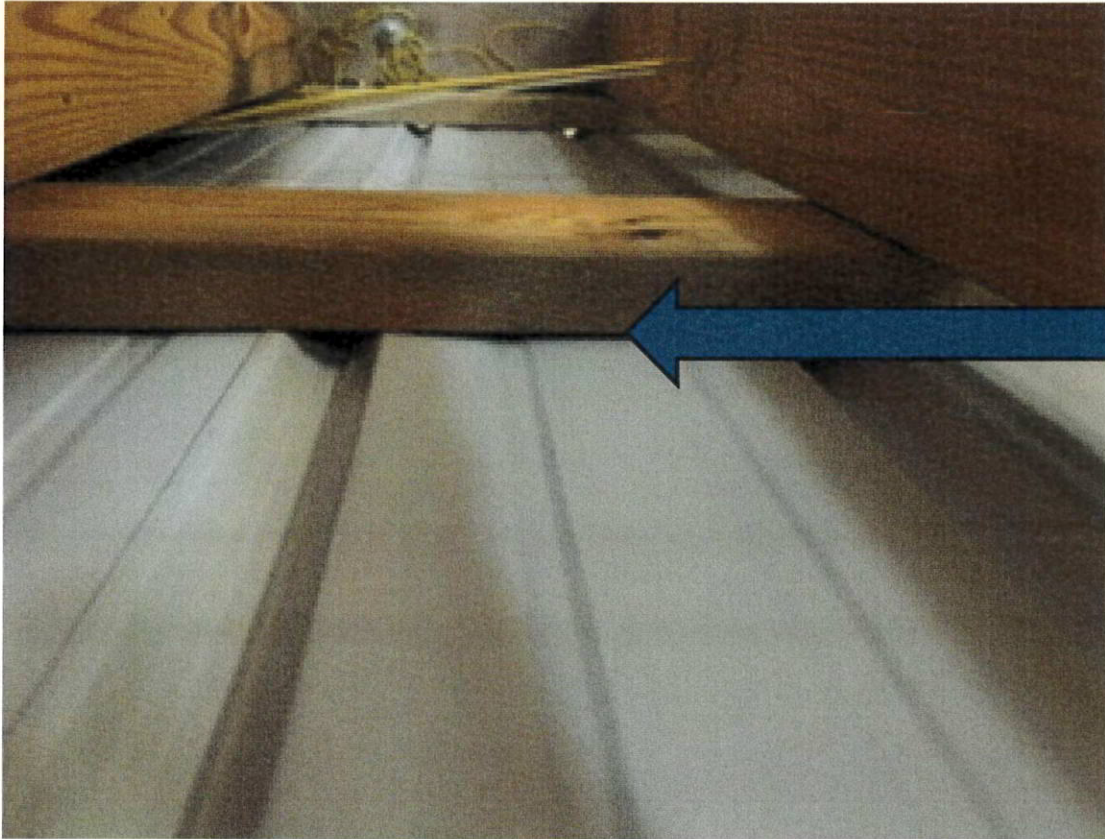


EXHIBIT B

Response of Buncombe County Permits and Inspections — July 24, 2026
Permit BLD2025-01146 • 153 Foxtail Trail, Asheville, NC 28806

Message record

From: Jason R. Rogers, Director, Buncombe County Permits and Inspections
<Jason.Rogers@buncombenc.gov>

To: Kyle Chandler <builtbykc@gmail.com>

Cc: Timothy T. Love, Assistant County Manager; Gary Brunault; Avril Pinder, County Manager

Date: Friday, July 24, 2026, 9:48 AM EDT

Subject: RE: Permit BLD2025-01146 — 153 Foxtail Trail — Written Questions Following July 16 Meeting — Response Requested by Tuesday, July 21

Attachments: None

Message text (verbatim)

All,

The information below needs to be sent to the Chief Code Consultant to be added to the appeals process. As a reminder we met the timelines and requirements of the Informal Review and the Alternative Method processes. State law has an appeals process for this purpose (G.S.140-143.1) where there are questions about local determinations, and it appears you have applied in this manner. We feel the questions below are answered in the report. The questions below do not change the local determination that this is not an approved material or method to remedy the current code violations.

We have rendered our decision and are awaiting the statutorily required response from the State on this appeal. We will uphold the State's decision once rendered.

Jason Rogers
Permits and Inspections, Director
35 Woodfin Street, Asheville, NC 28801
(828) 250-5384

This exhibit reproduces the message in full. It is the complete text of the response received to the ten numbered questions submitted July 17, 2026 (Exhibit A). The statute reference appears as written in the original. No attachment accompanied the message.

Submitted by Kyle E. Chandler, KC Construction Company LLC • NC General Contractor License #82407 • 188 Toronto Trail, Clyde, NC 28721 • (828) 545-9111 • builtbykc@gmail.com

EXHIBIT C

Email of Assistant County Manager Timothy Love — July 17, 2026
Permit BLD2025-01146 | 153 Foxtail Trail, Asheville, NC 28806

MESSAGE RECORD

From Timothy Love, Assistant County Manager, Buncombe County — Timothy.Love@buncombenc.gov
To Gary Brunault (gbrunault@att.net); Kyle Chandler (builtbykc@gmail.com)
Cc Jason R. Rogers, Director, Permits and Inspections (Jason.Rogers@buncombenc.gov)
Date Friday, July 17, 2026
Subject RE: [External] NOTICE OF APPEAL — Section 203.2.2 — Permit BLD2025-01146, 153 Foxtail Trail, Asheville NC — Determinations of June 29 and July 2, 2026

MESSAGE BODY (VERBATIM)

Gary/Kyle,

Per our meeting on Thursday, please see the below statute regarding alternative design construction, appeals and timeline for decision.

[Hyperlink in original to:

https://www.ncleg.net/EnactedLegislation/Statutes/HTML/BySection/Chapter_143/GS_143-140.1.html]

==

§ 143-140.1. Alternative design construction and methods; appeals.

The Building Code Council shall, by January 1, 2023, promulgate rules, procedures, and policies for the approval of alternative designs and construction that follow the North Carolina State Building Code. The Residential Code Council shall, by January 1, 2026, promulgate rules, procedures, and policies for the approval of alternative designs and construction that follow the North Carolina State Building Code. In the event of a dispute between a local authority having jurisdiction and the designer or owner-representative regarding alternative designs and construction, and notwithstanding any other section within this Article, appeals by the designer or owner-representative on matters pertaining to alternative design construction or methods shall be heard by the Engineering and Building Codes Division of the Department of Insurance. The Engineering and Building Codes Division shall issue its decision regarding an appeal filed under this section within 10 business days. The State Fire Marshal shall adopt rules in furtherance of this section. (2007-507, s. 18; 2022-11, s. 8(a); 2023-108, s. 1(a); 2023-151, s. 11.60(a); 2024-1, s. 6.4(k).)

Timothy Love
County Manager's Office — Assistant County Manager
(828) 250-5243
200 College Street, Asheville, NC 28801

Reproduced from the email as received. County and State email signature images, social media links, and standard confidentiality footers are omitted. The message was sent within an existing county email thread; prior messages in that thread are already part of the record before the Division.

HUNTSMAN

BUILDING SOLUTIONS

March 3, 2026

KC Construction Company, LLC
188 Toronto Trail
Clyde, NC
28721
Attn: Mr. Kyle Chandler-Proprietor

Re: Heatlok® HFO Pro and Foam-Lok FL500- Wall Assembly at 153 Foxtrail Trl., Asheville, NC 28806-
Fire Blocking Requirements

Dear Mr. Chandler,

This letter serves to confirm that you have described the application Heatlok® HFO Pro spray applied polyurethane foam insulation directly to the corrugated exterior metal siding at the floor/ceiling intersections followed by a full cavity fill application of Foam-Lok FL500 spray applied polyurethane foam insulation.

The 2024 North Carolina State Residential Code, Section R302.11: Fireblocking, states: ***“In combustible construction, fireblocking shall be provided to cut off both vertical and horizontal concealed draft openings and to form an effective fire barrier between stories, and between the top story and the roof space.*”**

The 2024 North Carolina State Residential Code, Section 202, defines Fireblocking as follows, “Building materials or materials approved for use as fireblocking, installed to resist the free passage of flame to other areas of the building through concealed spaces.”

The primary purpose of fire blocking is to prevent the vertical movement of flames, smoke, and gases within a building. Fire blocking achieves this by sealing off **gaps and hidden spaces**, which helps contain the fire to its original area. This containment provides occupants with more time to evacuate and allows firefighters to have more time to respond.

Moreover, fire blocking restricts the flow of oxygen, which is crucial for a fire to grow and spread. By limiting the airflow, fire blocking effectively slows down the combustion process, thereby aiding in the suppression of the fire.

The application described above includes a spray foam air impermeable insulation filled wall cavity inclusive of an air impermeable spray foam applied at the floor/ceiling intersections with the exterior wall. With the elimination of airspace, draft openings, gaps and hidden spaces resulting from this monolithically occupied wall assembly with spray polyurethane foam insulation renders an assembly containing no potential for vertical or horizontal concealed draft openings, the functionality surrounding the requirement for fireblocking, and as such Section R302.11 of the 2024 North Carolina State Residential Code is not applicable to this specific application.

With warm regards,

Paul Warren
Building Science and Engineering Manager

HUNTSMAN
BUILDING SOLUTIONS

Mobile: 520-610-6216 | Email: paul_warren@huntsman.com

Huntsman Building Solutions

HUNTSMAN

BUILDING SOLUTIONS

March 2, 2026

KC Construction Company, LLC
188 Toronto Trail
Clyde, NC
28721
Attn: Mr. Kyle Chandler-Proprietor

Re: Heatlok® HFO Pro- Water-Resistive Barrier (WRB)

Dear Mr. Chandler,

This letter serves to confirm that Heatlok® HFO Pro has been tested in accordance with ASTM E331-**Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference** with dimensions equaling 64ft² under a minimum differential pressure of 15lb/ft² for a minimum test exposure of 2-hours by third party, independent, accredited laboratory Intertek.

The International Residential Code, Section R703.1.1-**Water Resistance, Exception: 2**, states that compliance with R703.2-**Water-Resistive Barrier** and R703.4-**Flashing** shall not be required when it has been demonstrated to resist wind-driven rain in accordance with ASTM E331. Wall assemblies shall be a minimum of 4ft x 8ft (32ft²) and shall be tested at a minimum differential pressure of 6.24lb/ft² for a minimum testing exposure of 2 hours. Tests are deemed acceptable when no water penetration is observed during the test exposure. The results on a minimum of 1.25-inches of Heatlok® HFO Pro as tested in accordance with ASTM E331 showed that there was no water leakage under the prescribed conditions and duration of the test. (See attached figures)



HUNTSMAN BUILDING SOLUTIONS TEST REPORT

SCOPE OF WORK
ASTM E2357 AIR LEAKAGE and ASTM E331 TESTING ON HEATLOK HFO PRO

REPORT NUMBER
L4520.01-801-44 RO

Fig.1-Intertek Scope of Work

SECTION 8

TEST SPECIMEN DESCRIPTION

Product Type: Heatlok HFO Pro

Series/Model: 1.25" Closed-Cell Spray Foam Insulation

Wall #1: Opaque Wall

Product Size:

OVERALL AREA:	WIDTH		HEIGHT	
	millimeters	inches	millimeters	inches
5.9 m ² (64.0 ft ²)				
Overall Size	2438	96	2438	96

Fig. 2-Assembly Dimensions



Test Specimen #1: Opaque

TITLE OF TEST	RESULTS	ALLOWED	NOTE
Water Penetration, ASTM E331 per AC 71 at 720Pa (15 psf)	120 minutes	No leakage	

General Note: All testing was performed in accordance with the referenced standards.

Fig.3-Testing Results

SECTION 9 **CONCLUSION**

The mock-ups tested met the specified performance requirements set forth in ASTM E2357-11 and AC71 / ASTM E331.

Fig.4-Conclusion

In summary, Heatlok® HFO Pro has been evaluated and is in compliance with the requirements of the IRC Section R703.1.1, Exception 2 as a result of testing in accordance with ASTM E331 under the prescribed requirements showing no water leakage through the assembly and as such meets the intent of the building code for a water-resistive barrier when applied at a minimum thickness of 1.25-inches.

With warm regards,

Paul Warren
Building Science and Engineering Manager



Mobile: 520-610-6216 | **Email:** paul_warren@huntsman.com

Huntsman Building Solutions



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HUNTSMAN BUILDING SOLUTIONS, INC.
3315 East Division Street
Arlington, Texas 76011
Phone: (817) 640-4900
www.huntsmanbuilds.com

HEATLOK® HFO PRO SPRAY-APPLIED POLYURETHANE FOAM PLASTIC INSULATION

CSI Section:
07 21 00 Thermal Insulation

1.0 RECOGNITION

Heatlok® HFO Pro spray-applied polyurethane foam plastic insulation has been evaluated for use as spray foam insulation complying with IBC Section 2603; IRC Section R316; and 2021, 2018, 2015, and 2009 IECC Sections C303, C402, R303, and R402; and 2009 IECC Sections 303, 402, and 502. The physical properties, water vapor resistance, air permeance, thermal resistance, surface burning characteristics, fire-resistance, and attic and crawl space installations, and exterior walls of Types I-IV construction were evaluated to comply with the intent of the following codes and regulations:

- 2021, 2018, 2015, 2012, and 2009 International Building Code® (IBC)
- 2021, 2018, 2015, 2012, and 2009 International Residential Code® (IRC)
- 2021, 2018, 2015, 2012, and 2009 International Energy Conservation Code® (IECC)

2.0 LIMITATIONS

Use of the Heatlok® HFO Pro spray-applied polyurethane foam plastic insulation recognized in this report is subject to the following limitations:

2.1 The insulation and coating products shall be installed in accordance with the manufacturer's published installation instructions, this evaluation report, and the applicable code. If there are any conflicts between the manufacturer's published installation instructions and this report, the more restrictive shall govern.

2.2 Except as permitted by the applicable building code, the insulation shall be separated from the interior of the building by a code-complying thermal barrier or shall be installed as an alternative thermal barrier assembly in accordance with Section 4.5.1 of this report

2.3 The insulation shall not exceed the nominal density and thickness for the installation conditions described in this report.

2.4 During application, the insulation shall be protected from exposure to weather.

2.5 The insulation shall be installed by professional spray polyurethane foam installers authorized by Huntsman Building Solutions, Inc.

2.6 Use of the insulation in areas of "very heavy" termite infestation probability shall be in accordance with 2021, 2018, 2015, and 2009 IBC Section 2603.8, and 2012 IBC Section 2603.9, or IRC Section R318.4, as applicable.

2.7 Heatlok® HFO PRO insulation qualifies as a vapor retarder when installed as required in Section 4.7 of this report.

2.8 Labeling and jobsite certification of the insulations and coatings shall comply with the following code sections as applicable:

- 2021, 2018, 2015, or 2012 IBC Section 2603.2
- 2021, 2018, 2015, or 2012 IRC Section R316.2
- 2021, 2018, and 2015 IRC Section N1101.10.1.1
- 2012 IRC Section N1101.12.1.1
- 2009 IRC Section N1101.4
- 2021, 2018, 2015, or 2012 IECC Sections C303.1.1.1 or R303.1.1.1
- 2009 IECC Section 303.1.1.1

2.9 The insulation shall be produced by Huntsman Building Solutions, Inc. in Arlington, TX.

3.0 PRODUCT USE

Heatlok® HFO Pro spray-applied polyurethane foam plastic insulation complies with IBC Section 2603; IRC Section R316; and 2021, 2018, 2015, and 2012 IECC Sections C303, C402, R303, and R402; and 2009 IECC Sections 303, 402, and 502. When installed in accordance with Section 4.0 of this report, the foam plastic insulation is for use in wall cavities, floor assemblies or ceiling assemblies, exterior side of vertical foundations, or the underside of slabs. It may be used in attics and crawl spaces when installed with Section 4.5.1. Heatlok® HFO Pro insulation is used in Types I, II, III, IV, and V construction under the IBC and in one- and two-family dwellings under the IRC.

4.0 PRODUCT DESCRIPTION

4.1 Properties: Heatlok® HFO Pro is a medium density, closed cell, spray-applied polyurethane foam plastic insulation in accordance with Table 1 of AC308. The insulation has a nominal in-place density of 2.0 lb/ft³ (32 kg/m³). The two-component spray foam plastic is produced in the field by combining a polymeric isocyanate

The product described in this Uniform Evaluation Service (UES) Report has been evaluated as an alternative material, design or method of construction in order to safely and comply with the intent of the provision of the code, as noted in this report, and for at least equivalence to that prescribed in the code in quality, strength, effectiveness, fire resistance, durability and safety, as applicable, in accordance with IBC Section 104.11. This document shall only be reproduced in its entirety.

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(A component) and the Heatlok® HFO Pro resin (B component). The liquid components shall be stored in 55-gallon (208 L) drums at temperatures between 50°F and 100°F (10°C and 38°C) for the polymeric isocyanate and 59°F and 77°F (15°C and 25°C) for the Heatlok® HFO Pro resin. When Component A and Component B are stored in factory-sealed containers at the recommended temperatures, the maximum shelf life is twelve months for the polymeric isocyanate and six months for the Heatlok® HFO Pro resin.

4.2 Thermal Resistance (R-Values): Heatlok® HFO Pro spray-applied polyurethane foam plastic insulation has a thermal resistance (R-Value) at a mean temperature of 75°F (24°C) as shown in Table 1 of this report.

Thickness (inch)	Heatlok® HFO Pro R-Value (°F·ft ² ·h/Btu)
1	7.4
1.5	11
2	14
3	20
3.5	23
4	26
5	33
5.5	36
6	40
7	46
7.5	49
8	53
9	59
10	66
11	72
11.5	76
12	79

For SE: 1 inch = 25.4 mm, 1°F·ft²·h/Btu = 0.176 110 K·m²/W

¹R-Values are calculated based on tested K values at 1-inch and 4-inch thicknesses.

4.3 Surface Burning Characteristics: At a maximum thickness of 4 inches (102 mm) and a nominal density of 2.0 lb/ft³ (32 kg/m³), the Heatlok® HFO Pro insulation has a flame spread index of 25 or less and smoke-developed index of 450 or less when tested in accordance with ASTM E84. Greater thicknesses, depending on the end use, are recognized when installed in accordance with this report.

4.4 Fire-Protective Coatings and Coverings: Fire protective coatings, for use as alternative thermal barrier assemblies, shall be in accordance with Table 2 of this report, as applicable, and installed in accordance with Section 4.5 of this report.

4.5 Installations: Heatlok® HFO Pro spray-applied polyurethane foam plastic insulation shall comply with one of the following requirements:

- 2021, 2018, 2015, and 2012 IECC Section C402.1
- 2021, 2018, 2015, and 2012 IECC Section R402.1
- 2009 IECC Sections 402.1 or 502.1, as applicable

The manufacturer's published installation instructions for Heatlok® HFO Pro insulation and this report shall be available on the jobsite during installation. Where conflicts occur, the most restrictive governs.

Heatlok® HFO Pro insulation shall be spray-applied on the jobsite using equipment specified in the manufacturer's published installation instructions. The maximum in-service temperature for all areas shall not exceed the maximum temperature stated in the manufacturer's published installation instructions. The insulation shall be sprayed onto a clean, dry substrate that has been prepared in accordance with the manufacturer's installation instructions. The insulation shall not be used in electrical outlets or junction boxes or where the insulation will be in direct, continuous contact with water.

4.5.1 Thermal Barrier

4.5.1.1 Application with an Approved Thermal Barrier: Except as provided for in Section 4.5.1.2 of this report, Heatlok® HFO Pro spray-applied polyurethane foam plastic insulation shall be separated from the interior by a thermal barrier in accordance with IBC Section 2603.4 or IRC Section R316, as applicable. When the insulation is separated from the interior by a prescriptive thermal barrier in accordance with IBC Section 2603.4 or IRC Section R316, the insulation thickness shall not be limited.

4.5.1.2 Alternative Thermal Barrier Assemblies: Heatlok® HFO Pro spray-applied polyurethane foam plastic insulation may be installed without a thermal barrier as defined in Section 4.5.1.1 of this report when installed in accordance with Table 2 of this report and as referenced in [IAPMO UES ER-499](#) or additional report by an approved evaluation entity to the requirements of AC456.

4.5.2 Installation in Attics or Crawl Spaces: Heatlok® HFO Pro spray-applied polyurethane foam plastic insulation may be installed in attics or crawl spaces when installed in accordance with this section (Section 4.5).

When installed in attics or crawl spaces where entry is made only for the service of utilities, Heatlok® HFO Pro insulation may be installed in accordance with this section. Heatlok® HFO Pro insulation need not be surfaced with a thermal barrier, however, such attic and crawl space areas shall be separated from the interior of the building by a thermal barrier in accordance with Section 4.5.2 of this report.

4.5.2.1 Installation Using a Prescriptive Ignition Barrier: When installed within attics or crawl spaces where entry is made only for the service of utilities, Heatlok® HFO Pro spray-applied polyurethane foam plastic insulation, at a maximum thickness of 7.5 inches (191 mm) on walls and



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other vertical surfaces and 11.5 inches (292 mm) on ceilings and other overhead surfaces, shall be covered with a prescriptive ignition barrier in accordance with IBC Section 2603.4.1.6 or IRC Sections R316.5.3 and R316.5.4, as applicable.

Exception: The prescriptive ignition barrier may be omitted when installed in accordance with Section 4.5.2.2 of this report.

4.5.2.2 Installation Using an Alternative Ignition Barrier Assembly: Heatlok® HFO Pro spray-applied polyurethane foam plastic insulation may be installed in attics and crawl spaces using an alternative ignition barrier assembly provided:

- Entry is only to service utilities in the attic or crawl space and no storage is permitted.
- Attic or crawl space areas cannot be interconnected.
- Air from the attic or crawl space cannot be circulated to other parts of the building.
- Attic ventilation is provided as required by 2021 and 2018 IBC Section 1202.2, 2015 and 2012 IBC Section 1203.2, or IRC Section R806 except where air-impermeable insulation is permitted in unvented attics and shall comply with the following code sections as applicable:

For Unvented Attics:

- 2021 and 2018 IBC Section 1202.3
- 2015 IBC Section 1203.3
- 2021, 2018, 2015, 2012, and 2009 IRC Section R806.5

Crawl space ventilation is provided as required by the following code sections as applicable:

- 2021 and 2018 IBC Section 1202.4
- 2015 IBC Section 1203.4
- 2012 and 2009 IBC Section 1203.3
- 2018, 2015, 2012, and 2009 IRC Section R408.1

- The foam plastic insulation is limited to the maximum thickness and density tested as shown in Section 4.5.2.2.1 of this report.
- In accordance with IMC (International Mechanical Code®) Section 701, combustion air is provided.

4.5.2.2.1 Alternative Ignition Barrier Assembly: Heatlok® HFO Pro spray-applied polyurethane foam plastic insulation may be installed without a prescriptive ignition barrier on walls, floors, ceilings, and other vertical and horizontal surfaces as defined in Section 4.5.2.1 of this report when limited to a maximum thickness of 7.5 inches (191 mm) on walls and other vertical surfaces and 11.5 inches (292 mm) on ceilings and other overhead surfaces.

4.6 Air Permeability: When tested in accordance with ASTM E2178 at a minimum thickness of 1 inch (25.4 mm), Heatlok® HFO Pro spray foam insulation is classified as air-

impermeable insulation in accordance with Section 1202.3 of the 2021 and 2018 IBC, Section 1203.3 of the 2015 IBC, and Section R806.5 of the 2021, 2018, 2015, and 2012 IRC or Section R806.4 of the 2009 IRC, as applicable.

4.7 Vapor Permeance: Heatlok® HFO Pro spray-applied polyurethane foam plastic insulation, when tested in accordance with the ASTM E96 desiccant method (Procedure A), has a permeance of less than 1.0 perms ($57.4 \times 10^9 \text{ g/Pa}\cdot\text{s}\cdot\text{m}$), at a minimum thickness of 1 inch (25 mm) and qualifies as a Class II vapor retarder in accordance with IBC Section 202 and IRC Section R202.

4.8 One-hour Fire-resistance Rated Assembly: The following load-bearing assembly based on testing to ASTM E119 provides a one-hour fire-resistance rating.

Framing: 3¹/₈-inch (92 mm) 20-gauge steel studs with a maximum height of 10 feet (3 m) spaced at 16 inches (406 mm) on center inserted in a 20-gauge top and bottom steel track with lateral bracing at mid-wall height.

Exterior Surface: Two layers of 5/₈-inch-thick (15.9 mm) glass mat gypsum substrate complying with ASTM C1177. The base layer is installed with the long edge parallel to the studs with #6 by 1¹/₂-inch-long (38 mm) drywall screws spaced at 8 inches (203 mm) on center around the perimeter and 12 inches (305 mm) on center in the field. The face layer is installed with the long edge parallel to the studs with the base layer and face layer joints staggered by one stud space. The face wall is secured with #6 by 1⁷/₈-inch-long (48 mm) drywall screws spaced at 8 inches (203 mm) on center around the perimeter and 12 inches (305 mm) on center in the field.

Insulation: 3¹/₈-inch-thick (92 mm) layer of Heatlok® HFO Pro spray-applied polyurethane foam plastic insulation applied in the cavities to the exterior gypsum completely filling the stud cavities.

Interior Cladding: Two layers of 5/₈-inch-thick (15.9 mm) Type X gypsum board complying with ASTM C1396. The base layer shall be installed with the long edge parallel to the studs with #6 by 1¹/₂-inch-long (38 mm) drywall screws spaced at 8 inches (203 mm) on center around the perimeter and 12 inches (305 mm) on center in the field. The face layer shall be installed with the long edge parallel to the studs with the base layer and face layer joints staggered by one stud space. The face wall is secured with #6 by 1⁷/₈-inch-long (48 mm) drywall screws spaced at 8 inches (203 mm) on center around the perimeter and 12 inches (305 mm) on center in the field.

4.9 Exterior Walls of Buildings of Type I, II, III, or IV Construction: When Heatlok® HFO Pro spray-applied polyurethane foam plastic insulation is used in exterior walls of buildings of Type I, II, III, or IV construction of any height, the insulation shall comply with IBC Section 2603.5 and this section. Heatlok HFO Pro insulation shall be installed at a maximum thickness of 3¹/₈ inches (92 mm).



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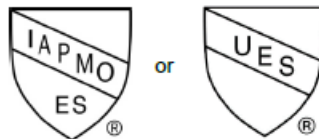
4.9.1 Complying Exterior Wall Assemblies: Wall assemblies that comply with Section 2603.5.5 of the IBC and this report that may be used in exterior walls of buildings of Type I, II, III, or IV construction of any height are described in Tables 3 and 4 of this report.

5.0 IDENTIFICATION

The spray foam insulation is identified with the following:

- Manufacturer's name (Huntsman Building Solutions), Inc.
- manufacturer's address and telephone number,
- the product trade name (Heatlok® HFO Pro)
- use instructions
- density, flame-spread and smoke-development indices
- date of manufacture or batch/run number
- thermal resistance values
- the evaluation report number (ER-565)
- the name or logo of the inspection agency

Either IAPMO UES Mark of Conformity may also be used as shown below:



IAPMO UES ER-565

6.0 SUBSTANTIATING DATA

6.1 Data in accordance with the ICC-ES Acceptance Criteria for Spray-applied Foam Plastic Insulation, **AC308**, dated April 2020 (editorially revised July 2020) including Appendix X.

6.2 Flammability Testing to NFPA 286, Standard Methods of Fire Tests for Evaluation of Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.

6.3 Report of air permeance testing in accordance with ASTM E2178.

6.4 Report of water vapor transmission performance in accordance with ASTM E96.

6.5 Fire-resistance testing to ASTM E119.

6.6 Report of fire-propagation characteristics tests in accordance with NFPA 285.

6.7 Third party engineering analysis for extension of NFPA 285 results.

6.8 IAPMO/ANSI ES1000-2020, Standard for Building Code Compliance of Spray-Applied Polyurethane Foam.

6.9 Data in accordance with 2019 ICC 1100 Standard for Spray-applied Polyurethane Foam Plastic Insulation.

6.10 Test reports are from laboratories in compliance with ISO/IEC 17025.

7.0 STATEMENT OF RECOGNITION

This evaluation report describes the results of research completed by IAPMO Uniform Evaluation Service on Heatlok® HFO Pro to assess conformance to the codes and standards shown in Section 1.0 of this report and documents the product's certification. The product is manufactured at location noted in Section 2.9 of this report under a quality control program with periodic inspections under the supervision of IAPMO UES

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



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TABLE 2 - ALTERNATIVE THERMAL BARRIER ASSEMBLY

FIRE-PROTECTIVE COATING/COVERING ¹			MAXIMUM SPF THICKNESS (inch)	
TYPE	MINIMUM THICKNESS	THEORETICAL APPLICATION RATE (COATINGS ONLY)	WALLS AND VERTICAL SURFACES	CEILING AND OVERHEAD SURFACES
DC315 ²	18 mils WFT (12 mils DFT)	1.1 gal/100 ft ²	7.5	11.5
Blazelok TBX ³	18 mils WFT (12 mils DFT)	1.1 gal/100 ft ²	7.5	11.5

For SI: 1 inch = 25.4 mm, 1 gallon = 3.785 L, 1 ft² = 0.0929 m²

¹ Fire-protective coatings and coverings shall be applied over all exposed SPF surfaces in accordance with the coating/covering manufacturer's instructions and this report.

² International Fireproof Technology, Inc. recognized in [IAPMO UES ER-499](#).

³ ICP Construction, recognized in ICC-ES ESR-3997

TABLE 3 - NFPA 285 COMPLYING EXTERIOR WALL ASSEMBLIES WITH HEATLOK® HFO PRO IN WALL CAVITY

Wall Component	Materials
Base Wall System (BWS)- Use either 1, 2, or 3	- Concrete Wall. - Concrete Masonry Wall. 1 layer of 5/8-inch-thick Type X gypsum wallboard installed on the interior side of minimum 3 5/8-inch deep, minimum 25-gauge equivalent thick steel studs spaced a maximum of 24 inches on center. Lateral bracing installed minimum every 4 foot vertically or as required.
Perimeter Fire Barrier System Use 1 and 2	- Perimeter fire barrier system complying with Section 715.4 of the IBC shall be installed, as applicable, to fill the void between the edge of the concrete floor slab and the interior surface of the exterior wall assembly. 4 pcf mineral wool in each stud cavity at each floor line, attached with Z-clips or friction fit.
Interior Insulation - Use either 1, 2, 3, 4 or 5 or combinations of 3 with 4 or 3 with 5.	- None - Maximum of 3 5/8-inch thickness of Heatlok® HFO Pro applied to interior surface of BWS 1 and 2¹ - Full wall stud cavity depth or less of Heatlok® HFO Pro applied using exterior gypsum sheathing of BWS 3 as the substrate and covering the width of the cavity and the inside of the steel wall stud framing flange. - Fiberglass batt insulation (faced or unfaced). - Mineral wool insulation (faced or unfaced).
Exterior Sheathing	5/8-inch-thick exterior type gypsum sheathing (for BWS 3 above).
Exterior wall covering ² - use either 1, 2 or 3	- Any non-combustible exterior wall covering material using any standard installation technique. - Any non-combustible exterior wall covering system with a combustible water-resistive barrier (WRB) that has successfully been tested in accordance with NFPA 285. - Any combustible exterior wall covering system with or without a combustible WRB that has successfully been tested in accordance with NFPA 285. - Table 4 below - Exterior Insulation 2 only with Claddings 6, 7 and 8 per Table 4 of this report (SPF as Exterior Insulation). Read notes carefully. - Table 4 below - Exterior Insulation 3 (with coating) only with Cladding 9 thru 18 per Table 4 of this report (SPF as Exterior Insulation). Read notes carefully.
Flashing of windows, doors, and other exterior wall penetrations	As an option, flash around windows, doors, and other exterior wall penetrations with limited amounts of maximum 12-inch-wide flashing tape (acrylic, asphalt or butyl based) or liquid applied membrane material with or without fiber mesh reinforcement.
Window Perimeter	The window header, jambs and sill are covered with 0.080-inch aluminum flashing. The edges and top of the assembly were sealed with steel flashing. Windows and Doors shall be framed as required for the base wall.

For SI: 1 inch = 25.4 mm; 1lb/ft²=16 kg/m²

¹ Fireblocking per Section 718 of the 2021, 2018, 2015, and 2012 IBC and Section 717 of the 2009 IBC and thermal barrier material requirements must be met for BWS 1 and 2, as required by specific wall construction details when combustible concealed space is created on the exterior side of the exterior wall assembly.

² Combustible exterior wall coverings shall be installed in accordance with manufacturer's installation requirements.



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TABLE 4 – NFPA 285 COMPLYING EXTERIOR WALL ASSEMBLIES WITH HEATLOK® HFO INSTALLED ON THE EXTERIOR SIDE OF THE WALL ASSEMBLY

Wall Component	Materials
Base Wall System (BWS)- Use either 1, 2, or 3	- Concrete Wall. - Concrete Masonry Wall. 1 layer of 5/8-inch-thick Type X gypsum wallboard installed on the interior side of minimum 3 5/8-inch deep, minimum 25-gauge equivalent thick steel studs spaced a maximum of 24 inches on center. Lateral bracing installed minimum every 4 foot vertically or as required.
Perimeter Fire Barrier System Use 1 or 2.	- Perimeter fire barrier system complying with Section 715.4 of the IBC shall be installed, as applicable, to fill the void between the edge of the concrete floor slab and the interior surface of the exterior wall assembly. - Wall stud cavities shall be filled at each floor line with minimum 4 lb/ft³ mineral wool friction fit between steel wall studs, attached with Z-clips or friction fit.
Interior Insulation – Use either 1, 2, 3, 4 or 5 or combinations of 3 with 4 or 3 with 5.	- None - Full wall stud cavity depth or less of Heatlok® HFO Pro applied using exterior gypsum sheathing of BWS 3 as the substrate and covering the width of the cavity and the inside of the steel wall stud framing flange.⁴ - Fiberglass batt insulation (faced or unfaced) - Mineral wool insulation (faced or unfaced)
Exterior Sheathing – use either 1 or 2	- None (for BWS 1 or 2 above) 5/8-inch thick Type X exterior type gypsum sheathing (for BWS 3 above)
Exterior Insulation Use 1, 2, or 3	- Maximum 3 1/2-inch thickness of Heatlok® HFO Pro (with Claddings 1-5, 2-inch maximum air gap between cladding and SPF). - Maximum 3-inch HeatLok HFO Pro SPF (with Claddings 6, 7 and 8. Horizontal purlin every 2 feet maximum, no vertical Z girts. Purlin depth 1-inch deeper than SPF thickness. 1-inch maximum air gap between cladding and SPF). - Maximum 3 3/4-inch HeatLok HFO Pro (with Claddings 9-18, use coating – 18 mils WFT DC315 with nine mils WFT Sherwin Williams Sher-Cryl HPA Topcoat with horizontal Z Girts 28 inches on center. 2-inch maximum air gap between cladding and SPF).
Exterior wall covering – use any item 1-20 with specific insulation or coating – read carefully. IMPORTANT Use 1-5 only with Exterior Insulation 1 Use 6, 7 and 8 only with Exterior Insulation 2 Use 9-18 only with Exterior Insulation 3 1-inch maximum air gap between cladding and SPF for cladding 6, 7 and 8 and insulation 2. 2-inch maximum air gap with cladding 1-5 or claddings 9 through 18. (continued on next page)	For use with Exterior Insulation 1 - Brick – Standard type brick veneer anchors, installed a maximum of 24 inches on center, vertically on each stud with maximum 1-inch air gap between exterior insulation and brick. Brick to be standard nominal 4-inch thick clay brick installed in a running bond pattern using Type S mortar. - Stucco – Minimum 3/4-inch thick, exterior plaster and lath. A secondary water resistive barrier (WRB) can be installed between the exterior insulation and lath. The secondary WRB shall not be full coverage asphalt or butyl based self-adhered membranes. - Minimum 2-inch thick natural stone (granite, limestone, marble or sandstone) Any standard non-open joint installation technique shall be used. - Minimum 1 1/2-inch thick concrete masonry unit (CMU), precast concrete or artificial cast stone. Any standard non-open jointed method shall be used. - Minimum 1 1/4-inch thick terra cotta non-open jointed. Any standard non-open jointed installation technique shall be used. For use with Exterior Insulation 2 - Vertical or horizontal flat 20 gauge minimum steel (or zinc galvanized steel) panels directly attached to horizontal purlin. Non-open joint. - STK 1000, STK 1500 Force Five, STK 2000, STK 2500 Force Five, STK 5000 or STK 5500 Force Five panels or equivalent. Non-open joint. - Vertical or horizontal corrugated 20 gauge minimum steel (or galvanized steel) panels (2-inch maximum corrugation depth) directly attached to horizontal purlin with no air gap (between cladding and SPF) at the shallowest depth of corrugation profile. Non-open joint. For use with Exterior Insulation 3 - Aluminum cladding – 3 mm minimum thickness, open or non-open joint. - Steel cladding - 0.0149-inch minimum thickness, open or non-open joint. - Copper cladding – 0.0216-inch minimum thickness, open or non-open joint. - Zinc cladding – 4 mm minimum thickness, open or non-open joint. 1/4-inch minimum fiber cement cladding, open or non-open joint



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	14. Concrete – minimum 1-inch thick, open or non-open joint. 15. Concrete Masonry Units – minimum 1-inch thick open or non-open joint 16. Stone Veneer – minimum 1-inch thick, open or non-open joint. 17. One Coat Stucco – 3/8-inch minimum exterior cement plaster and lath, non-open joint. 18. Thin Brick adhered (with noncombustible mortar) to stucco base (minimum 1/4-inch) non-open joint.
Flashing of window, door and other exterior wall penetrations	As an option, flash around window, door and other exterior wall penetrations with limited amounts of maximum 12-inch wide flashing tape (acrylic, asphalt, or butyl based) or liquid applied membrane material with or without fiber mesh reinforcement.
Window Perimeter	Materials for Openings Perimeters For Exterior Insulations 1 or 2 with no coating over the foam, use 18 gauge minimum sheet steel perimeter flashing. Windows and doors shall be framed as required for the base wall. For Exterior Insulation 3 with the coating over the foam, use 26 gauge minimum aluminum perimeter flashing. Windows and doors shall be framed as required for the base wall.

For SI: 1 inch = 25.4 mm; 1lb/ft³=16 kg/m³

¹Fireblocking per Section 718 of the 2021, 2018, 2015, and 2012 IBC and Section 717 of the 2009 IBC and thermal barrier material requirements must be met for BWS 1 and 2, as required by specific wall construction details when combustible concealed space is created on the interior side of the exterior wall assembly.

HUNTSMAN BUILDING SOLUTIONS TEST REPORT

SCOPE OF WORK

ASTM E2357 AIR LEAKAGE and ASTM E331 TESTING ON HEATLOK HFO PRO

REPORT NUMBER

L4520.01-801-44 R0

TEST DATES

10/15/20 - 10/23/20

ISSUE DATE

11/18/20

RECORD RETENTION END DATE

11/05/24

PAGES

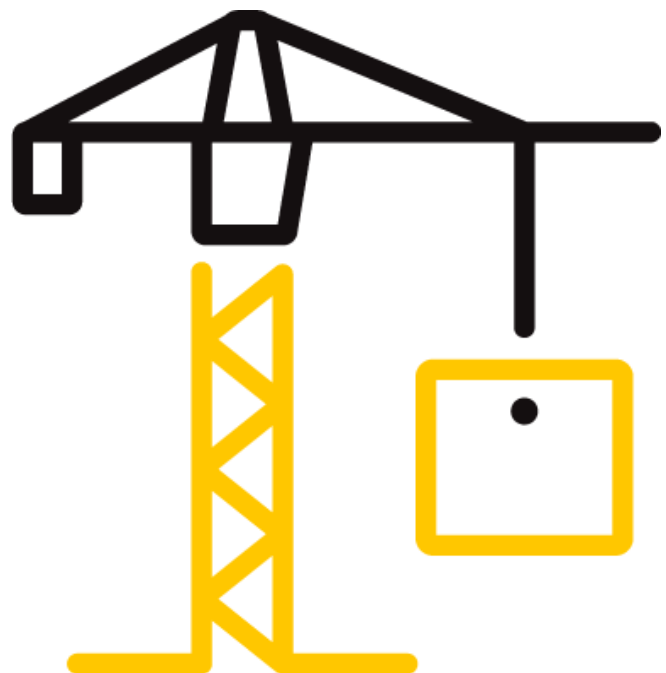
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DOCUMENT CONTROL NUMBER

ATI 00523 (07/24/17)

RT-R-AMER-Test-2813

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TEST REPORT FOR HUNTSMAN BUILDING SOLUTIONS

Report No.: L4520.01-801-44 R0

Date: 11/18/20

REPORT ISSUED TO

HUNTSMAN BUILDING SOLUTIONS DBA DEMILEC USA LLC

3315 E. Division Street

Arlington, Texas 76011

SECTION 1

SCOPE

Intertek Building & Construction (B&C) was contracted by Huntsman Building Solutions dba *DEMILEC USA LLC* to perform air leakage testing in accordance with ASTM E2357 and ASTM E331 on Heatlok HFO Pro air barrier assembly. The mock-ups tested were representative of target installation methods. Testing was performed on one opaque wall and one penetrated wall. Reference Product sampling report L3592.01-801-47 dated 8/28/20 for product sampling information.

Results obtained are tested values and were secured by using the designated test methods. Testing was conducted at Intertek B&C test facility in Plano, TX. This report does not constitute certification of this product nor an opinion or endorsement by this laboratory.

This report is not intended as a comprehensive evaluation of the system regarding performance and application to specific buildings.

SECTION 2

SUMMARY OF TEST RESULTS

SPECIMEN	TEST PROTOCOL	TEST RESULTS AT 75 PA
#1 Opaque Wall	ASTM E2357-11	0.0024 (L/s•m ²)
#2 Penetrated Wall	ASTM E2357-11	0.0047 (L/s•m ²)
SPECIMEN	TEST PROTOCOL	TEST RESULTS AT 300 PA
#1 Opaque Wall	ASTM E2357-11	0.0094 (L/s•m ²)
#2 Penetrated Wall	ASTM E2357-11	0.0060 (L/s•m ²)
SPECIMEN	TEST PROTOCOL	TEST RESULTS AT 15 PSF
#1 Opaque Wall	ASTM E331	No Leakage

For INTERTEK B&C:

COMPLETED BY:	Fred Munoz	REVIEWED BY:	Andy Cost
TITLE:	Project Manager	TITLE:	Lab Manager
SIGNATURE:		SIGNATURE:	
DATE:	11/18/20	DATE:	11/18/20

SC:AC

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TEST REPORT FOR HUNTSMAN BUILDING SOLUTIONS

Report No.: L4520.01-801-44 R0

Date: 11/18/20

SECTION 3

TEST METHODS

The specimens were evaluated in accordance with the following:

ASTM E2357-11, *Standard Test Method for Determining Air Leakage of Air Barrier Assemblies*

ASTM E283-04(2012), *Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen*

ASTM E330/E330M-14, *Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference*

ASTM E331-00 (2016), *Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference*

AC 71 1-2018, *Foam Plastic Sheathing Panels Used as Weather-resistive Barriers*

SECTION 4

MATERIAL SOURCE/INSTALLATION

Test specimens were provided by the client. Representative samples of the test specimens will be retained by Intertek B&C for a minimum of four years from the test completion date.

Test Wall #1 Opaque Wall Installation: Installation was performed by the client.

Test Wall #2 Penetrated Wall Installation: Installation was performed by the client.

TEST REPORT FOR HUNTSMAN BUILDING SOLUTIONS

Report No.: L4520.01-801-44 R0

Date: 11/18/20

SECTION 5**EQUIPMENT**

Cycling Mechanism: Computer controlled centrifugal blower with electronic pressure measuring device

Deflection Measuring Device: Linear transducers, and 1" dial indicators.

SECTION 6**LIST OF OFFICIAL OBSERVERS**

NAME	COMPANY
Andy Cost	Intertek B&C
Fred Munoz	Intertek B&C

SECTION 7**TEST PROCEDURE**

A series of laboratory tests were performed to determine air leakage resistance, wind load performance, and durability of air barrier coating. The installations were tested for air leakage and structural performance testing using ASTM E2357, ASTM E283, ASTM E330, and ASTM E331. The durability of the selected installations was evaluated and re-testing for air leakage was performed.

Tape and film were not used to seal against air leakage during structural testing.

TEST REPORT FOR HUNTSMAN BUILDING SOLUTIONS

Report No.: L4520.01-801-44 R0

Date: 11/18/20

SECTION 8

TEST SPECIMEN DESCRIPTION

Product Type: Heatlok HFO Pro

Series/Model: 1.25" Closed-Cell Spray Foam Insulation

Wall #1: Opaque Wall

Product Size:

OVERALL AREA:	WIDTH		HEIGHT	
	millimeters	inches	millimeters	inches
5.9 m ² (64.0 ft ²)				
Overall Size	2438	96	2438	96

Test Wall Construction: The opaque wall was constructed of 2 x 4 Spruce-Pine-Fir studs, spaced 16" on center. The wall was sheathed with nominal 1/2" thick Dens Glass and secured with #6 x 1-5/8" drywall screws spaced 8" on center. The Dens Glass sheathing was applied with one 8' long horizontal seam and two 4' long vertical seams with no sealant applied. A 1-1/4" thick layer of Heatlok HFO Pro Closed-Cell Spray Foam Insulation was applied to the sheathing and relied upon as the air sealing material. The wall utilized a 2 x 10 Spruce-Pine-Fir wood wrap around the perimeter to facilitate testing.

Wall #2: Penetrated Wall

Product Size:

OVERALL AREA:	WIDTH		HEIGHT	
	millimeters	inches	millimeters	inches
5.9 m ² (64.0 ft ²)				
Overall Size	2438	96	2438	96

Test Wall Construction: The penetrated wall was constructed of 2 x 4, Spruce-Pine-Fir studs, spaced 16" on center. The wall was sheathed with nominal 1/2" thick Dens Glass and secured with #6 x 1-5/8" drywall screws spaced 8" on center. The Dens Glass sheathing was applied with one 8' long horizontal seam and two 4' long vertical seams with no sealant applied. The penetrations included a 625 mm by 1225 mm rough opening with a 600 mm by 1200 mm window blank, a 100 mm by 100 mm HVAC duct, a 38 mm PVC pipe, six brick ties and two junction box penetrations; one square and one octagon per ASTM E2357. The window rough opening was sealed by applying Sopraseal Stick Liquid Flashing and Heatlok HFO Pro ABS peel and stick flashing. The other penetrations and perimeter joint were sealed with Heatlok HFO Pro ABS sealant. A 1-1/4" thick layer of Heatlok HFO Pro Closed-Cell Spray Foam Insulation was applied to the sheathing and relied upon as the air sealing material for the penetrations. The wall utilized a 2 x 10 Spruce-Pine-Fir wood wrap around the perimeter to facilitate testing.

TEST REPORT FOR HUNTSMAN BUILDING SOLUTIONS

Report No.: L4520.01-801-44 R0

Date: 11/18/20

SECTION 8

TEST RESULTS

The temperature during testing was 22°C (73°F). The results are tabulated as follows:

Wall #1: Opaque Wall

Test Method: ASTM E2357-11

Test Date / Time: 08/23/20 / 8:00AM

Air Infiltration (before loading sequence)

PRESSURE	TOTAL LEAKAGE (cfm)	TARE (cfm)	SPECIMEN LEAKAGE (cfm)	LEAKAGE RATE	
				(L/s•m ²)	(cfm/ft ²)
25 Pa (0.52 psf)	1.65	1.65	0.00	0.00	<0.0001
50 Pa (1.04 psf)	2.30	2.30	0.00	0.00	<0.0001
75 Pa (1.57 psf)	2.93	2.93	0.00	0.00	<0.0001
100 Pa (2.09 psf)	3.36	3.36	0.00	0.00	<0.0001
150 Pa (3.13 psf)	4.23	4.23	0.00	0.00	<0.0001
250 Pa (5.22 psf)	5.35	5.35	0.00	0.00	<0.0001
300 Pa (6.27 psf)	6.10	6.10	0.00	0.00	<0.0001

Air Exfiltration (before loading sequence)

PRESSURE	TOTAL LEAKAGE (cfm)	TARE (cfm)	SPECIMEN LEAKAGE (cfm)	LEAKAGE RATE	
				(L/s•m ²)	(cfm/ft ²)
25 Pa (0.52 psf)	1.70	1.70	0.00	0.00	<0.0001
50 Pa (1.04 psf)	2.47	2.47	0.00	0.00	<0.0001
75 Pa (1.57 psf)	3.09	3.09	0.00	0.00	<0.0001
100 Pa (2.09 psf)	3.63	3.63	0.00	0.00	<0.0001
150 Pa (3.13 psf)	4.55	4.55	0.00	0.00	<0.0001
250 Pa (5.22 psf)	5.99	5.99	0.00	0.00	<0.0001
300 Pa (6.27 psf)	6.56	6.56	0.00	0.00	<0.0001

Note: Reference Section 11 for Air Leakage Charts and 95% confidence Interval.

TITLE OF TEST	PRESSURE	TEST RESULTS
Deformation (10 second load)	±100 Pa (±2.09 psf)	No damage
	±200 Pa (±4.18 psf)	No damage
	±300 Pa (±6.27 psf)	No damage
	±400 Pa (±8.36 psf)	No damage
	±500 Pa (±10.45 psf)	No damage
Deformation (60 minute load)	±600 Pa (±12.54 psf)	No damage
Cyclic Loading (2000 cycles)	±800 Pa (±16.72 psf)	No damage
Gust Loading (3 second load)	±1200 Pa (±25.06 psf)	No damage

TEST REPORT FOR HUNTSMAN BUILDING SOLUTIONS

Report No.: L4520.01-801-44 R0

Date: 11/18/20

Wall #1: Opaque Wall

Test Method: ASTM E2357-11

Test Date / Time: 04/10/18 / 1:00PM

Air Infiltration (after loading sequence)

PRESSURE	TOTAL LEAKAGE (cfm)	TARE (cfm)	SPECIMEN LEAKAGE (cfm)	LEAKAGE RATE	
				(L/s•m ²)	(cfm/ft ²)
25 Pa (0.52 psf)	1.65	1.65	0.00	0.00	<0.0001
50 Pa (1.04 psf)	2.30	2.30	0.00	0.00	0.0000
75 Pa (1.57 psf)	2.95	2.93	0.01	0.01	0.0005
100 Pa (2.09 psf)	3.37	3.36	0.01	0.01	0.0005
150 Pa (3.13 psf)	4.23	4.23	0.00	0.00	0.0000
250 Pa (5.22 psf)	5.51	5.35	0.17	0.17	0.0058
300 Pa (6.27 psf)	6.15	6.10	0.05	0.05	0.0019

Air Exfiltration (after loading sequence)

PRESSURE	TOTAL LEAKAGE (cfm)	TARE (cfm)	SPECIMEN LEAKAGE (cfm)	LEAKAGE RATE	
				(L/s•m ²)	(cfm/ft ²)
25 Pa (0.52 psf)	1.70	1.70	0.00	0.00	<0.0001
50 Pa (1.04 psf)	2.48	2.47	0.01	0.01	0.0005
75 Pa (1.57 psf)	3.10	3.09	0.01	0.01	0.0005
100 Pa (2.09 psf)	3.63	3.63	0.00	0.00	<0.0001
150 Pa (3.13 psf)	4.57	4.55	0.03	0.03	0.0009
250 Pa (5.22 psf)	6.00	5.99	0.01	0.01	0.0005
300 Pa (6.27 psf)	6.64	6.56	0.08	0.08	0.0028

Note: Reference Section 11 for Air Leakage Charts and 95% confidence Interval.

TITLE OF TEST	PRESSURE	TEST RESULTS mm (inches)
		NET Deflection
Wind Pressure Loading (10 second load)	+1440 Pa (+30.09 psf)	9.65 (0.38)
	-1440 Pa (-30.09 psf)	10.41 (0.41)

Note: See Section 12, Sketch #1, for indicator locations.

TEST REPORT FOR HUNTSMAN BUILDING SOLUTIONS

Report No.: L4520.01-801-44 R0

Date: 11/18/20

Wall #2: Penetrated Wall

Test Method: ASTM E2357-11

Test Date / Time: 10/15/20 / 10:00AM

Air Infiltration (before loading sequence)

PRESSURE	TOTAL LEAKAGE (cfm)	TARE (cfm)	SPECIMEN LEAKAGE (cfm)	LEAKAGE RATE	
				(L/s•m ²)	(cfm/ft ²)
25 Pa (0.52 psf)	0.85	0.85	0.00	0.00	<0.0001
50 Pa (1.04 psf)	1.29	1.29	0.00	0.00	<0.0001
75 Pa (1.57 psf)	1.66	1.66	0.00	0.00	<0.0001
100 Pa (2.09 psf)	2.00	2.00	0.00	0.00	<0.0001
150 Pa (3.13 psf)	2.59	2.59	0.00	0.00	<0.0001
250 Pa (5.22 psf)	3.54	3.54	0.00	0.00	<0.0001
300 Pa (6.27 psf)	3.98	3.98	0.00	0.00	<0.0001

Air Exfiltration (before loading sequence)

PRESSURE	TOTAL LEAKAGE (cfm)	TARE (cfm)	SPECIMEN LEAKAGE (cfm)	LEAKAGE RATE	
				(L/s•m ²)	(cfm/ft ²)
25 Pa (0.52 psf)	0.88	0.88	0.00	0.00	<0.0001
50 Pa (1.04 psf)	1.34	1.34	0.00	0.00	<0.0001
75 Pa (1.57 psf)	1.75	1.75	0.00	0.00	<0.0001
100 Pa (2.09 psf)	2.15	2.15	0.00	0.00	<0.0001
150 Pa (3.13 psf)	2.81	2.81	0.00	0.00	<0.0001
250 Pa (5.22 psf)	3.89	3.89	0.00	0.00	<0.0001
300 Pa (6.27 psf)	4.34	4.34	0.00	0.00	<0.0001

Note: Reference Section 11 for Air Leakage Charts and 95% confidence Interval.

TITLE OF TEST	PRESSURE	TEST RESULTS
Deformation (10 second load)	±100 Pa (±2.09 psf)	No damage
	±200 Pa (±4.18 psf)	No damage
	±300 Pa (±6.27 psf)	No damage
	±400 Pa (±8.36 psf)	No damage
	±500 Pa (±10.45 psf)	No damage
Deformation (60 minute load)	±600 Pa (±12.54 psf)	No damage
Cyclic Loading (2000 cycles)	±800 Pa (±16.72 psf)	No damage
Gust Loading (3 second load)	±1200 Pa (±25.06 psf)	No damage

TEST REPORT FOR HUNTSMAN BUILDING SOLUTIONS

Report No.: L4520.01-801-44 R0

Date: 11/18/20

Wall #2: Penetrated Wall

Test Method: ASTM E2357-11

Test Date / Time: 05/11/18 / 8:00 AM

Air Infiltration (after loading sequence)

PRESSURE	TOTAL LEAKAGE (cfm)	TARE (cfm)	SPECIMEN LEAKAGE (cfm)	LEAKAGE RATE	
				(L/s•m ²)	(cfm/ft ²)
25 Pa (0.52 psf)	0.85	0.85	0.00	0.00	0.0000
50 Pa (1.04 psf)	1.31	1.29	0.03	0.03	0.0009
75 Pa (1.57 psf)	1.69	1.66	0.03	0.03	0.0009
100 Pa (2.09 psf)	2.03	2.00	0.03	0.03	0.0009
150 Pa (3.13 psf)	2.63	2.59	0.04	0.04	0.0014
250 Pa (5.22 psf)	3.58	3.54	0.04	0.04	0.0014
300 Pa (6.27 psf)	4.01	3.98	0.03	0.03	0.0012

Air Exfiltration (after loading sequence)

PRESSURE	TOTAL LEAKAGE (cfm)	TARE (cfm)	SPECIMEN LEAKAGE (cfm)	LEAKAGE RATE	
				(L/s•m ²)	(cfm/ft ²)
25 Pa (0.52 psf)	0.88	0.88	0.00	0.00	<0.0001
50 Pa (1.04 psf)	1.35	1.34	0.01	0.01	0.0005
75 Pa (1.57 psf)	1.77	1.75	0.01	0.01	0.0005
100 Pa (2.09 psf)	2.16	2.15	0.01	0.01	0.0005
150 Pa (3.13 psf)	2.81	2.81	0.00	0.00	<0.0001
250 Pa (5.22 psf)	3.90	3.89	0.01	0.01	0.0005
300 Pa (6.27 psf)	4.35	4.34	0.01	0.01	0.0005

Note: Reference Section 11 for Air Leakage Charts and 95% confidence Interval.

TITLE OF TEST	PRESSURE	TEST RESULTS mm (inches)
		NET Deflection
Wind Pressure Loading (10 second load)	+1440 Pa (+30.09 psf)	14.22 (0.56)
	-1440 Pa (-30.09 psf)	14.22 (0.56)

Note: See Section 12, Sketch #2, for indicator locations.

TEST REPORT FOR HUNTSMAN BUILDING SOLUTIONS

Report No.: L4520.01-801-44 R0

Date: 11/18/20

Test Specimen #1: Opaque

TITLE OF TEST	RESULTS	ALLOWED	NOTE
Water Penetration, ASTM E331 per AC 71 at 720Pa (15 psf)	120 minutes	No leakage	

General Note: All testing was performed in accordance with the referenced standards.

SECTION 9

CONCLUSION

The mock-ups tested met the specified performance requirements set forth in ASTM E2357-11 and AC71 / ASTM E331.

TEST REPORT FOR HUNTSMAN BUILDING SOLUTIONS

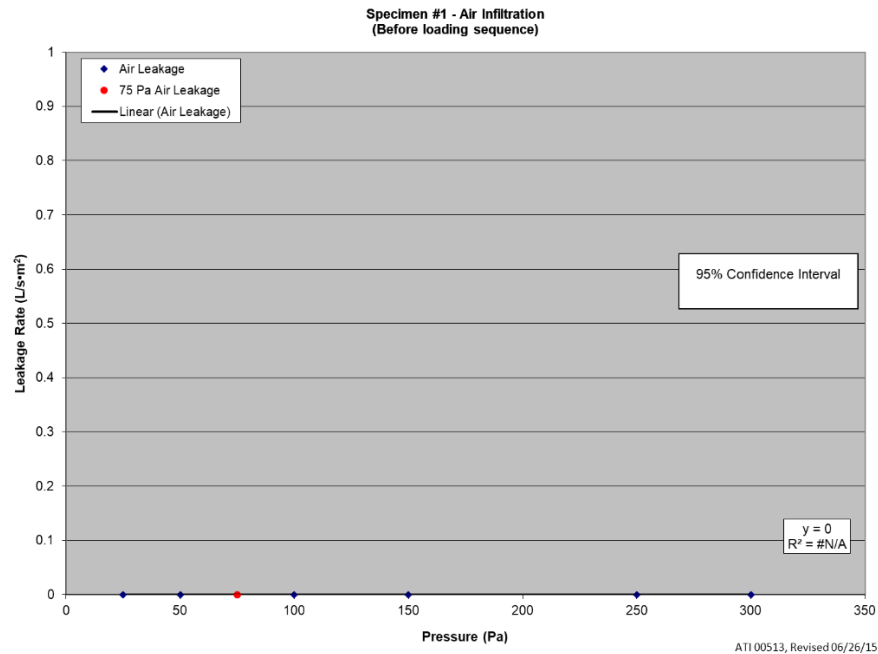
Report No.: L4520.01-801-44 R0

Date: 11/18/20

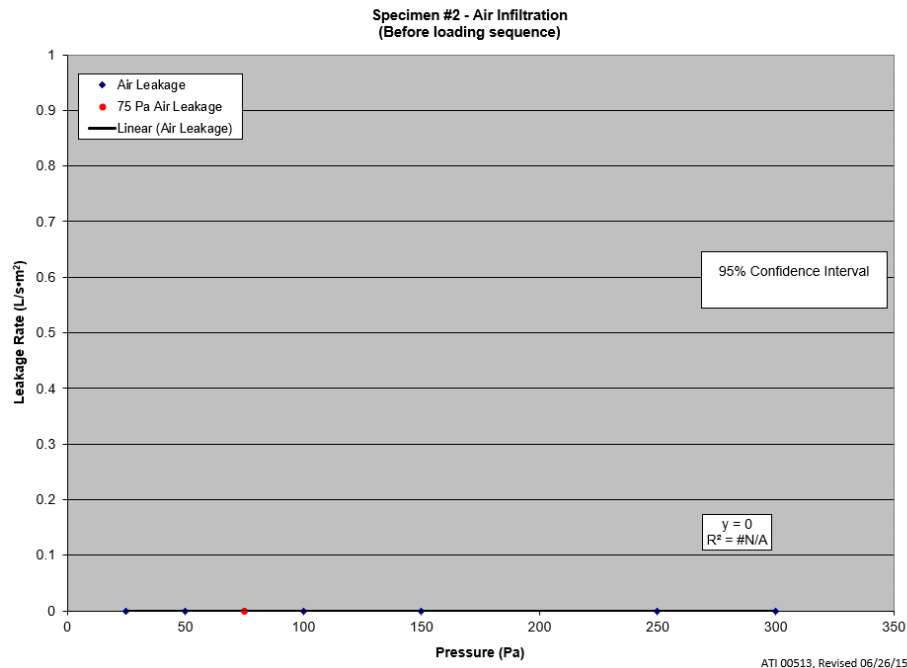
SECTION 10

ASTM E2357-11 CHARTS

Test Report No.: i5897.01-801-44



Test Report No.: i5897.01-801-44

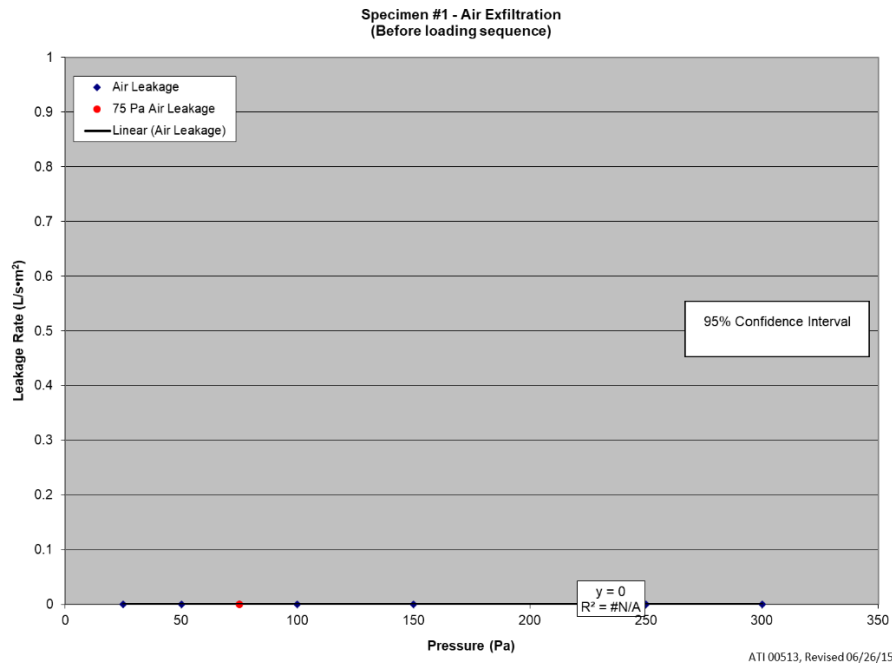


TEST REPORT FOR HUNTSMAN BUILDING SOLUTIONS

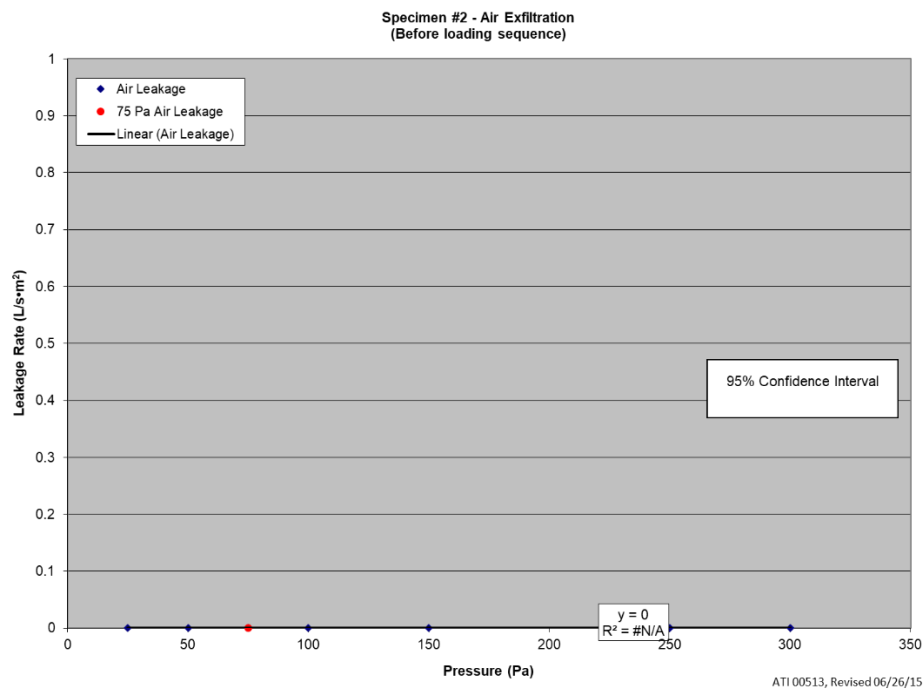
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Date: 11/18/20

Test Report No.: i5897.01-801-44



Test Report No.: i5897.01-801-44

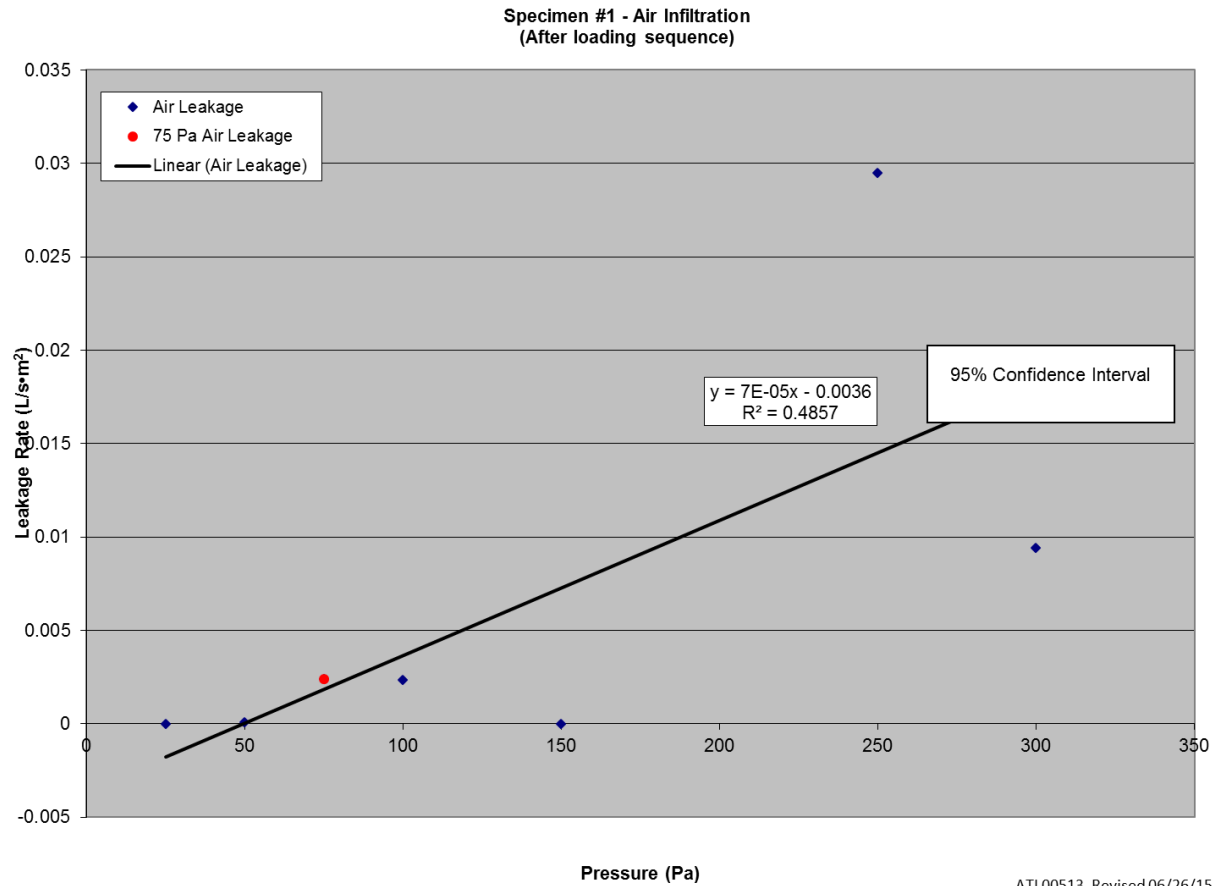


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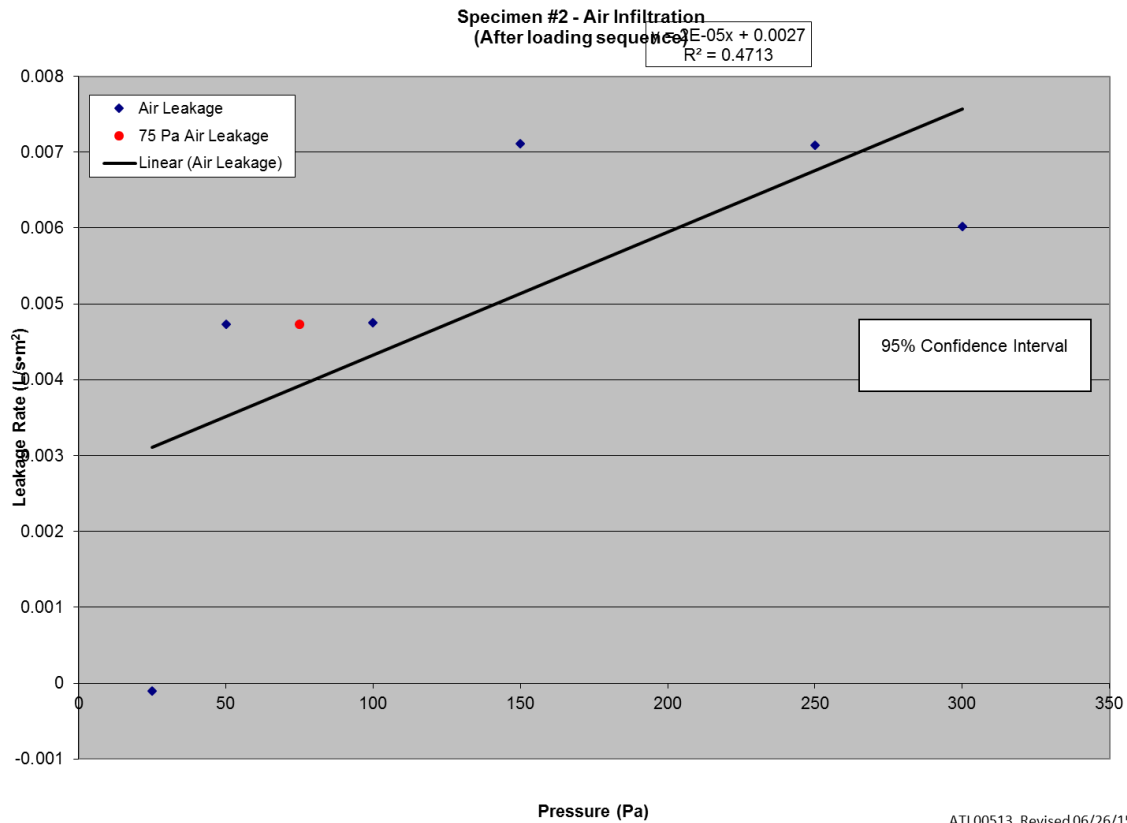
ATI 00513, Revised 06/26/15

TEST REPORT FOR HUNTSMAN BUILDING SOLUTIONS

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Date: 11/18/20

Test Report No.: L4520.01-801-44



ATI 00513, Revised 06/26/15

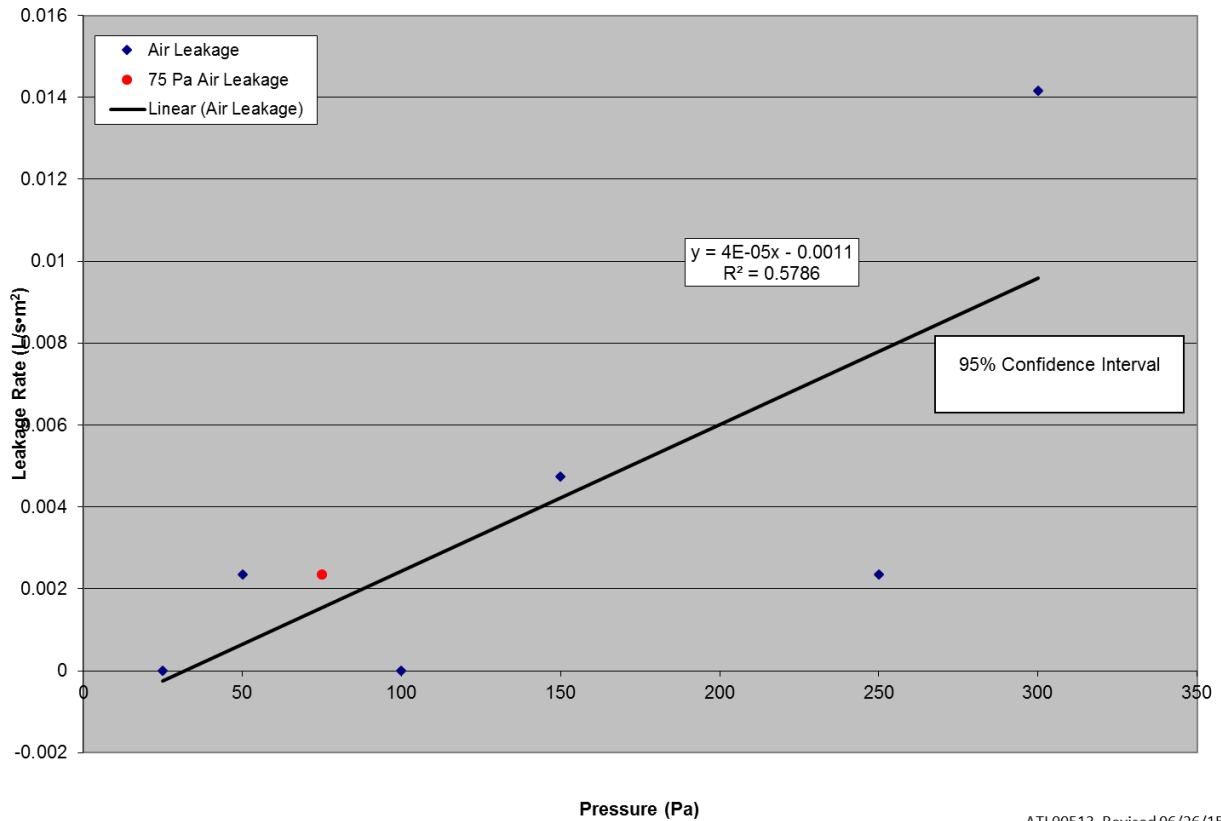
TEST REPORT FOR HUNTSMAN BUILDING SOLUTIONS

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**Specimen #1 - Air Exfiltration
(After loading sequence)**



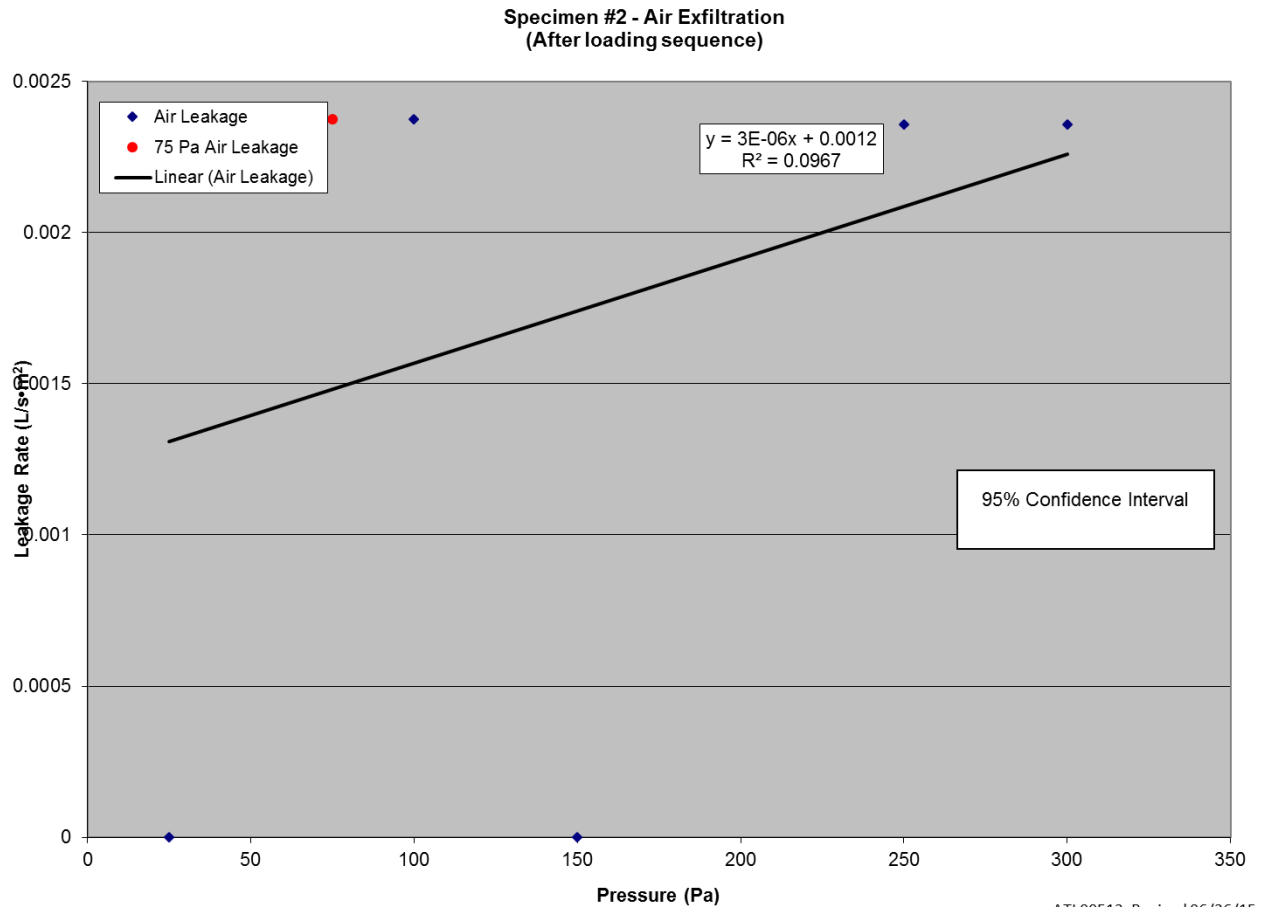
ATI 00513, Revised 06/26/15

TEST REPORT FOR HUNTSMAN BUILDING SOLUTIONS

Report No.: L4520.01-801-44 R0

Date: 11/18/20

Test Report No.: L4520.01-801-44

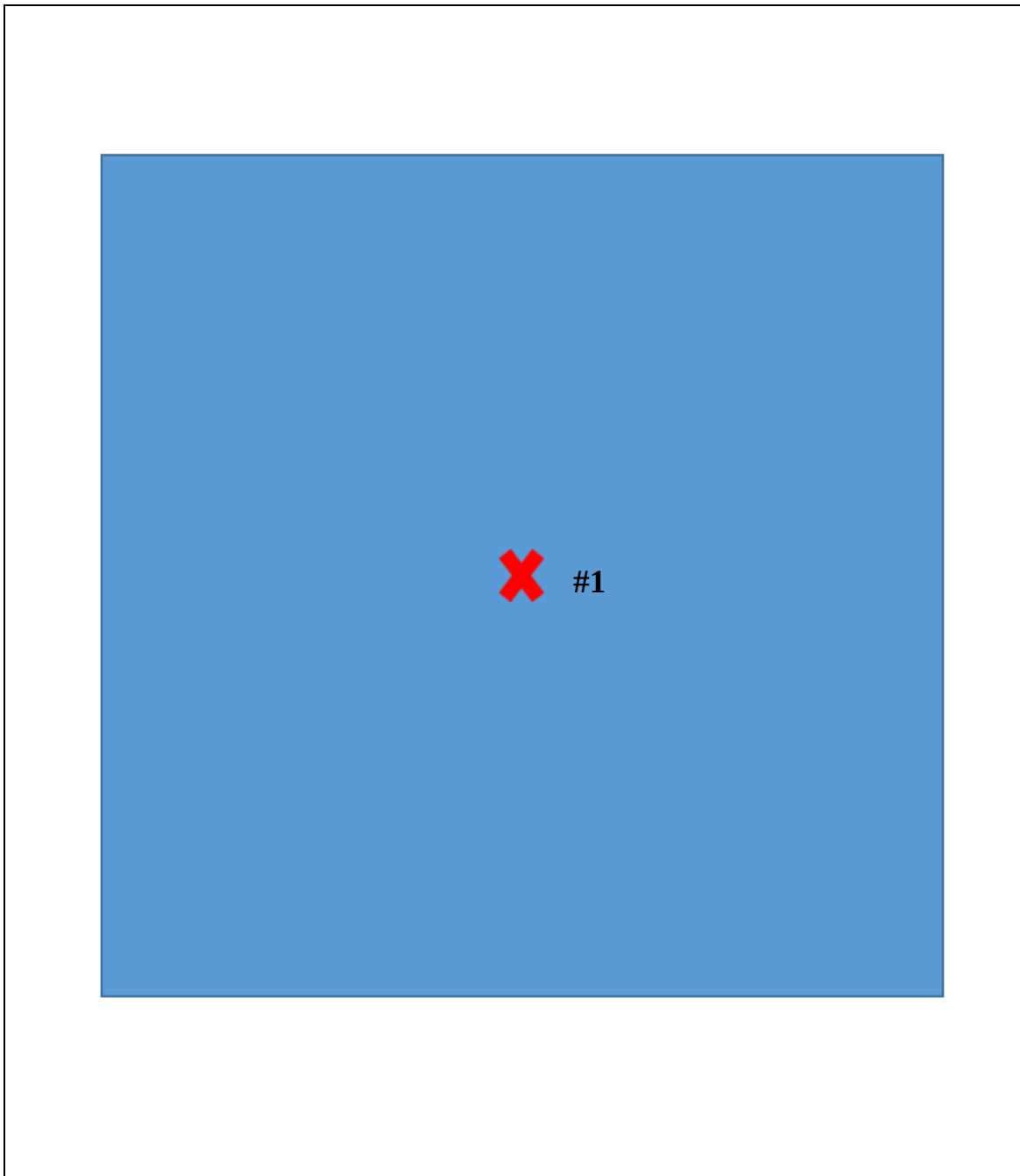


TEST REPORT FOR HUNTSMAN BUILDING SOLUTIONS

Report No.: L4520.01-801-44 R0

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SECTION 11
SKETCHES

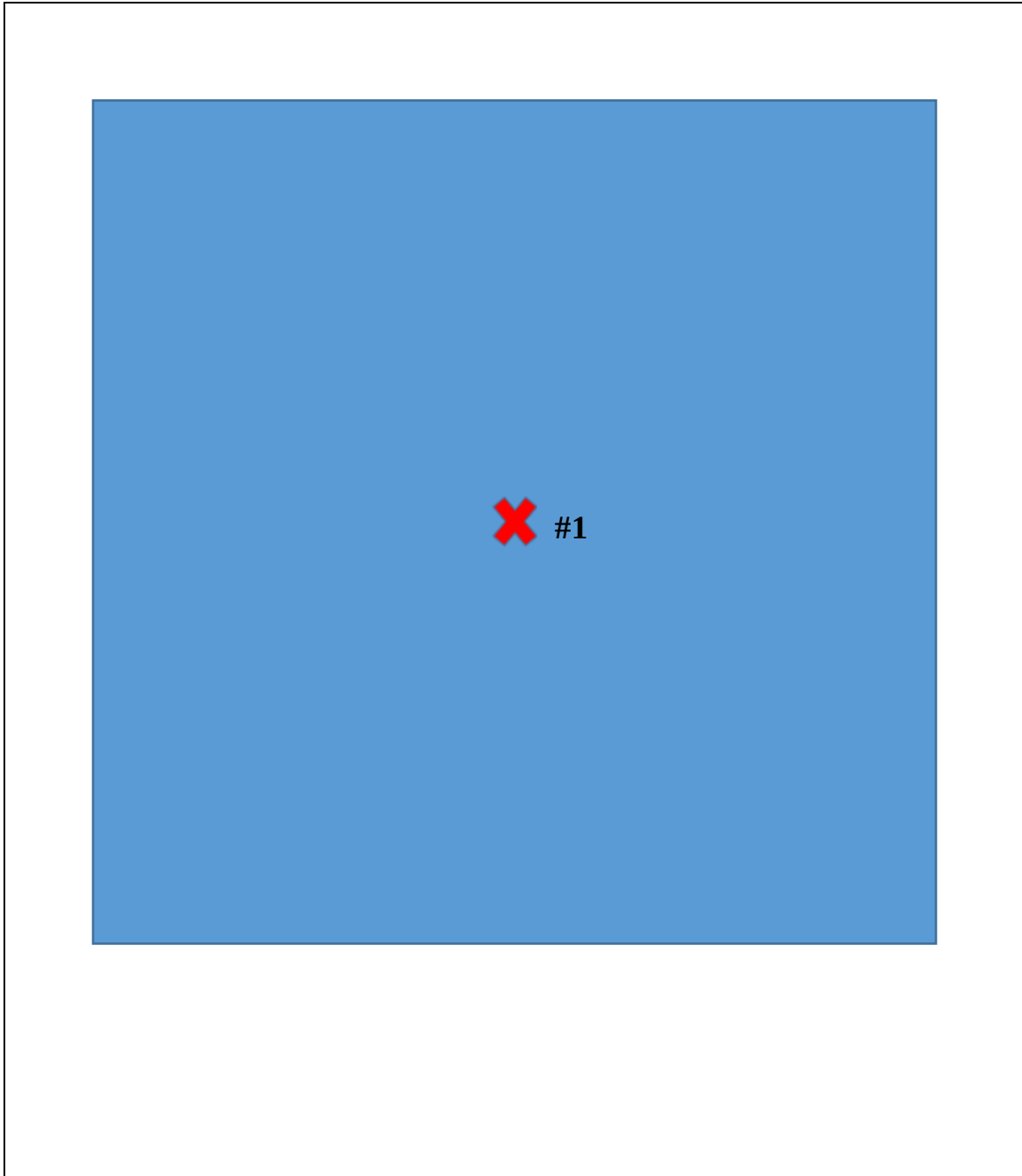


Sketch No. 1
Indicator Locations - Wall #1

TEST REPORT FOR HUNTSMAN BUILDING SOLUTIONS

Report No.: L4520.01-801-44 R0

Date: 11/18/20



Sketch No. 2
Indicator Locations - Wall #2

TEST REPORT FOR HUNTSMAN BUILDING SOLUTIONS

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Date: 11/18/20

SECTION 12

PHOTOGRAPHS



Photo No. 1
Opaque Wall

TEST REPORT FOR HUNTSMAN BUILDING SOLUTIONS

Report No.: L4520.01-801-44 R0

Date: 11/18/20



Photo No. 2
Penetrated Wall

TEST REPORT FOR HUNTSMAN BUILDING SOLUTIONS

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Date: 11/18/20



Photo No. 3

Liquid Primer and Heatlok HFO Pro Peel and Stick flashing at window opening

TEST REPORT FOR HUNTSMAN BUILDING SOLUTIONS

Report No.: L4520.01-801-44 R0

Date: 11/18/20



Photo No. 4

Heatlok HFO Pro Sealant at penetration perimeter



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www.intertek.com/building

TEST REPORT FOR HUNTSMAN BUILDING SOLUTIONS

Report No.: L4520.01-801-44 R0

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SECTION 13

REVISION LOG

REVISION #	DATE	PAGES	REVISION
0	11/18/20	N/A	Original Report Issue