
SPRAY POLYURETHANE FOAM ALLIANCE

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Mr. Michael Beaton, P.E.
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5360 Workman Mill Road
Whittier, California 90601

March 6, 2009

Subject: Attic and Crawlspace Test Proposal for AC-377

Dear Mr. Beaton –

On behalf of the SPFA, I would like to submit the following two documents to support our new attic and crawlspace fire test proposal. The first document outlines the test method, and the second provides suggested changes to AC-377 that will incorporate this new test procedure.

This proposal represents voluntary contributions from a task force consisting of more than fifteen different supplier members of SPFA. It took 14 months of hard work, and its final form has been endorsed by a significant majority of the task force members. Our work has been guided by a world-class fire testing consultant, and has been reviewed by other members of the foam plastics industry.

I would also like to thank you for granting us a few extra days to complete this proposal. I understand the next step in the process will be for ICC-ES staff to prepare our proposal for internal review. Please feel free to contact me should you have any questions during the subsequent stages of the review process.

Respectfully yours,

Richard S. Duncan, Ph.D., P.E.
Technical Director

[Add as new Appendix X]

Appendix X

Fire Test Method for Attics and Crawl Spaces

Scope: The objective of this test is to evaluate the fire performance of spray-applied, polyurethane foam plastic insulation materials (SPF) when tested in a room/corner test configuration to determine if the insulation and/or the insulation system is acceptable for use in attics and crawl spaces without prescriptive ignition barriers per IRC or IBC.

Test Method: The test method to be used is the NFPA 286 “Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth” with the modifications described below. All test requirements, procedures, and conditions specified in NFPA 286 shall be followed except as described below.

Modifications to NFPA 286:

1. Ignition Source –The standard gas burner shall be used. The burner shall be positioned such that it is in contact with both sidewalls in the test corner of the fire test room as indicated in Figure 3.
2. Specimen Mounting: The test specimens can be mounted in either of two configurations. Whichever configuration is used, the interior room dimensions as required by NFPA 286 shall be maintained. The two configurations are:
 - a. The fire test room shall be completely lined with one layer of 5/8 inch thick, Type X gypsum wallboard. The SPF shall be applied directly to the gypsum wallboard at the maximum thickness and density intended for use. The SPF shall be applied to both the three test walls and the test ceiling. If a covering is used over the foam, it shall be applied to both the walls and the ceiling at the same minimum thickness or coverage rate intended for use.
 - b. The three walls of the test room without the doorway will be constructed with wood studs sized to the same depth as the test specimen, 93 inches high, 24 inches on center with a single top and bottom plate, as shown in Figure 1. The exterior side of the walls will be covered with one layer of 5/8 inch thick, Type X gypsum wallboard. The SPF will be sprayed to fill each stud cavity and be continuous from the bottom plate to the top plate and from stud to stud. The ceiling of the test room will be constructed as shown in Figure 2. The ceiling will consist of wood joists sized to the same depth as the test specimen at 24 inches on center. A total of five joists will be used and they will run parallel with the 12 ft. length of the test room (front to back). The two outboard joists will rest on the top plates of the walls. The exterior side of the ceiling will be covered with one layer of 5/8 inch thick, Type X gypsum wallboard. The SPF will be

sprayed to fill each joist cavity and will be continuous from the front to the back and from joist to joist. If a covering is used over the foam, it shall be applied to both the walls and the ceiling at the same minimum thickness or coverage rate intended for use.

3. Test Corner Configuration – During the installation of the SPF, care shall be taken to provide as smooth a surface as possible especially in the wall areas that will be adjacent to as well as above the burner. The maximum allowable deviations are described in Figure 3.
4. Test Data – During the test, all of the following test parameters shall be determined:
 - a. Time at which the Heat Release Rate exceeds 1 MW,
 - b. Time at which the heat flux to the floor exceeds 20 kW/m²,
 - c. Time at which the average upper layer temperature exceeds 600°C, and
 - d. Time at which flames exit the doorway
5. Reporting – The following additional items shall be reported:
 - a. Type, description, average thickness and nominal density of the SPF wall and ceiling specimens.
 - b. Type, description, and nominal thickness (i.e. mils) or application rate (i.e. gallons per 100 square feet) of coating.
 - c. Time recorded for each test parameter from Item 4 above.
 - d. Average of the four time values indicated in Item 5-c.
6. Acceptance Criteria – A test shall be determined to be successful when the average time for attainment of the four measured test parameters (Item 5-d above) is 4 minutes 18 seconds or greater. This acceptance criterion is based on testing performed with a code prescribed ignition barrier over foam plastic insulation.

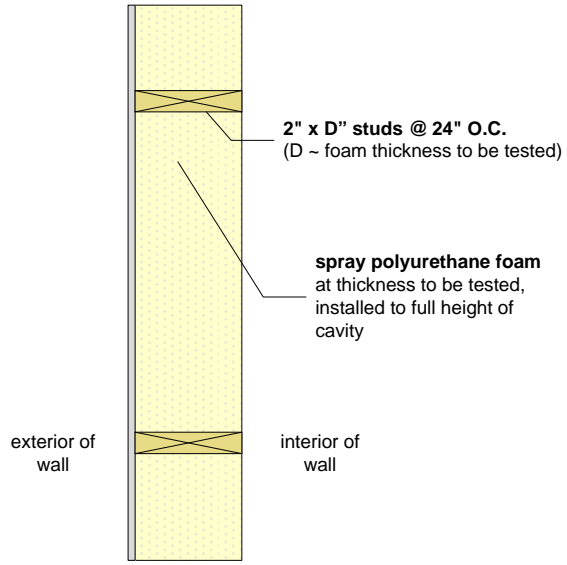


Figure 1 – Top view of wall construction

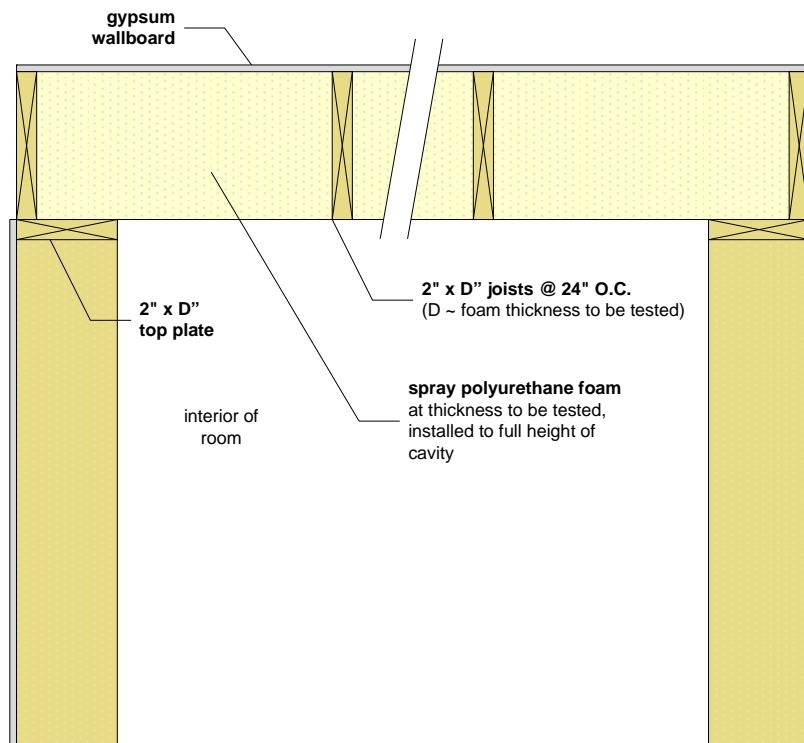
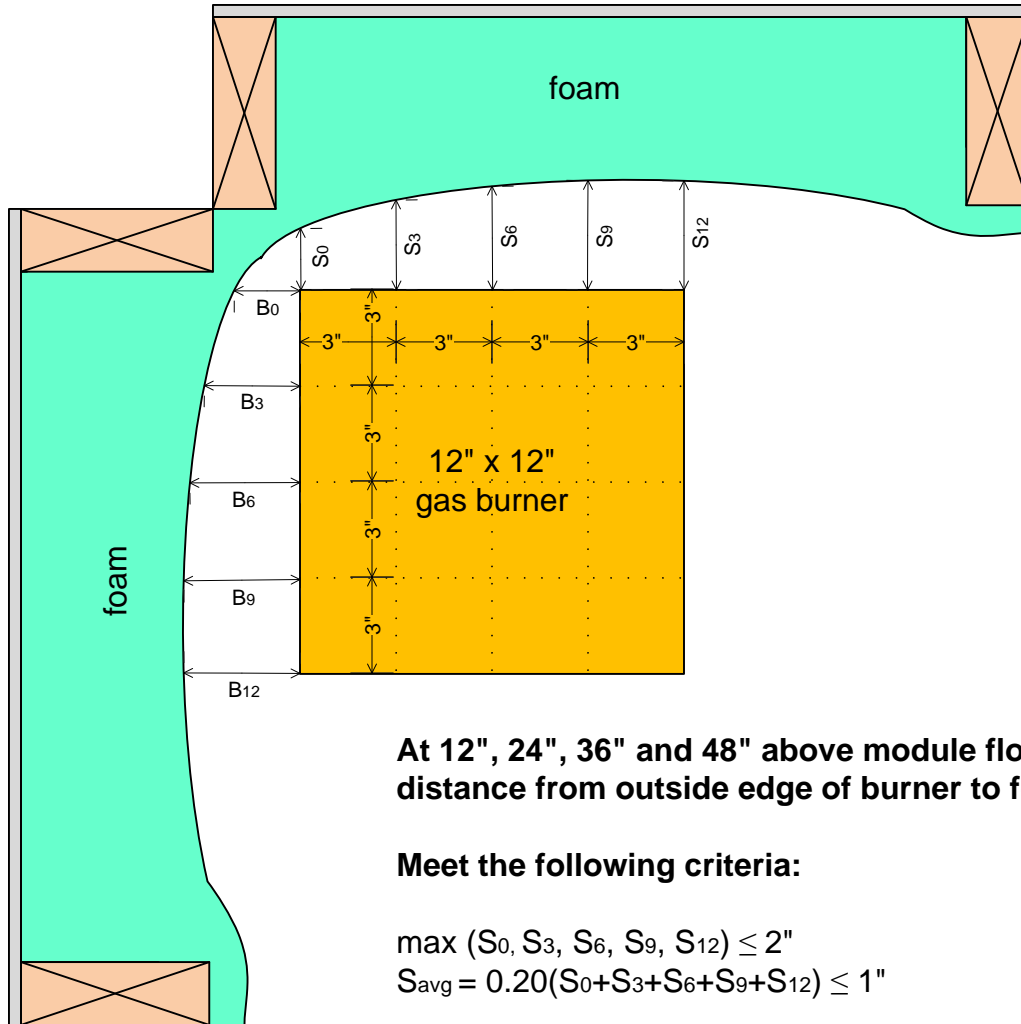


Figure 2 - Side view of ceiling construction



At 12", 24", 36" and 48" above module floor, measure distance from outside edge of burner to foam surface.

Meet the following criteria:

$$\max (S_0, S_3, S_6, S_9, S_{12}) \leq 2"$$

$$S_{avg} = 0.20(S_0 + S_3 + S_6 + S_9 + S_{12}) \leq 1"$$

$$\max (B_0, B_3, B_6, B_9, B_{12}) \leq 2"$$

$$B_{avg} = 0.20(B_0 + B_3 + B_6 + B_9 + B_{12}) \leq 1"$$

Figure 3- Measurement points for burner spacing from foam

Revise Section 3.4.4 of AC377 to read:

3.4.4 Spray-applied Foam Plastic Used in Attic and Crawl Spaces: Within an attic or crawl space where entry is made only for the service of utilities, spray-applied foam plastics shall be protected as set for the in IBC section 2603.4.1.6, IRC Section R314.5.3 or R314.5.4 or Exception 4 of UBC Section 2602.4. Utilities include, but are not limited to, mechanical equipment, electrical wiring, fans, plumbing, gas or electric hot water heaters and gas or electric furnaces.

As an alternative, the prescriptive ignition barrier shall not be required when satisfactory testing is conducted in accordance with 3.4.4.1 or 3.4.4.2.

3.4.4.1 For Use on Walls or Floors or Underside of Roofs in Attics or on Walls or Floors or Underside of Floors in Crawl Spaces: Tests shall be conducted in accordance with NFPA 286 with the conditions of acceptance specified in IBC Section 803.2; or UL 1715 or UBC Standard 26-3 with conditions of acceptance as specified in Section 3.3.3.2.3 of AC377. The tests must be conducted with the foam plastic installed at the maximum thickness and density for which recognition is sought over the gypsum wallboard or glass-reinforced cement board, as described in the standard. Coverings, if part of the insulation system, must be tested at the minimum thickness or coverage rate for which recognition is sought.

3.4.4.1.1 Limitations: When testing is in accordance with Section 3.4.4.1, the evaluation report shall include the following limitations:

- a. Attic ventilation is provided in accordance with IBC Section 1203.2 or IRC Section R806 as applicable.
- b. Under-floor (crawl space) ventilation is provided in accordance with IBC Section 1203.3 or IRC Section R408 as applicable.
- c. Combustion air is provided in accordance with IMC Sections 701 and 703
- d. The foam plastic insulation is limited to the maximum thickness and density tested.
- e. Coverings, if part of the insulation system, are limited to the minimum thickness or coverage rate tested.

3.4.4.2 For Use on Walls or Floors or Underside of Roofs in Attics or on Walls or Floors or Underside of Floors in Crawl Spaces: The tests shall be conducted in accordance with the test methods described in either Appendix A (for Crawl Spaces only) or Appendix X (for Attics and Crawl Spaces) of AC-377. The Conditions of Acceptance shall be as described in Appendix A or Appendix X. The tests must be conducted with the foam plastic installed at the maximum thickness and density for which recognition is sought. Coverings, if part of the insulation system, must be tested for approval. Coverings, if part of the insulation system, must be tested at the minimum thickness or coverage rate for which recognition is sought.

3.4.4.2.1 Acceptance: Successful passage of the Crawl Space test in Appendix A allows use on walls or floors or the underside of floors in crawl spaces. Successful testing based on Appendix X allows use on walls or floors or underside of roofs in attics or on walls or floors or underside of floors in crawl spaces.

3.4.4.2.2 Floors

Although floors are not specifically tested in Appendix A or Appendix X, approval can be gained such that the maximum thickness for floors is the maximum thickness successfully tested in either Appendix A or Appendix X.

3.4.4.2.3 Limitations: When testing is in accordance with Section 3.4.4.2, the evaluation report shall include the following limitations:

- a. Entry into the attic or crawl space is only for service to utilities and no storage is permitted.
- b. There are no interconnected attic areas.
- c. There are no interconnected crawl space areas.
- d. Air in either the attic or the crawl space is not circulated to other parts of the building.
- e. Attic ventilation is provided in accordance with IBC Section 1203.2 or IRC Section R806 as applicable.
- f. Under-floor (crawl space) ventilation is provided in accordance with IBC Section 1203.3 or IRC Section R408 as applicable.
- g. Combustion air is provided in accordance with IMC Sections 701 and 703
- h. The foam plastic insulation is limited to the maximum thickness and density tested.
- i. Coverings, if part of the insulation system, are limited to the minimum thickness or coverage rate tested.

Replace existing Appendices A, B and C with:

**Appendix A
Comparison Testing for use in Crawl Spaces**

A1.0 Use in Crawl Spaces – Comparison Test

A1.1 For Use on Walls or Floors or the Underside of Floors in a Crawl Space:

Comparative crawl space fire tests shall be conducted in accordance with Section A 1.2 where the performance of the exposed foam plastic insulation is compared under identical test conditions to that of the foam plastic insulation covered with a code-approved ignition barrier.

A1.2 TEST METHOD – CRAWL SPACES

A1.2.1 TEST CONFIGURATION

A sub-floor assembly is mounted on top of a three-sided wall module. The simulated crawl space module consists of three 8-ft. square (outside dimensions ± 2 -in.) walls, each 48 ± 2 -in. high, and built of nominal 4-in. wide x 8-in. high x 16-in. long concrete blocks with a full open space on one side of the structure. Masonry walls or module walls constructed of wood or metal studs with two layers of $\frac{1}{2}$ -in. gypsum board are permitted provided the interior dimensions are the same as for a concrete block module, i.e., 88 ± 2 -in. wide and 92 ± 2 -in. deep. If wood or metal stud construction is used, the studs shall be located inside the module, i.e., the width of the module is equal to the distance between the interior faces of the gypsum board attached to the side walls and the depth is equal to the distance between the front opening and the interior face of the gypsum board attached to the back wall.

The floor/ceiling above the crawl space is built using nominal 2 x 8-in. x 8-ft. floor joists on 16-in. centers, with 2 x 8-in. joist headers, all bearing on 2 x 4-in. sill plates and surfaced with $\frac{15}{32}$ -in. thick, 4-ply, APA graded A-C plywood sub-flooring. The use of joists and headers with a larger depth, e.g., 2 x 10-in., 2 x 12-in., etc. is permitted at the client's request.

Note 1: The use of CDX grade plywood is considered too variable in quality for comparison purposes required for this evaluation.

Note 2: All construction lumber (joists and studs, if used) shall be of the same species and grade for all tests conducted to qualify a foam plastic insulation.

The joists are perpendicular to the camera's line-of-sight, so that they tend to dam the flame front and hold it inside the test area. The floor of the test chamber is covered with approximately 1-in. of sand. To provide additional protection, it is acceptable to cover the floor with $\frac{1}{2}$ -in. gypsum board before installing the 1-in. layer of sand.

A1.2.2 IGNITION SOURCE

The fire source is a 22-lb wood crib constructed of nominal 2 x 2-in. No. 1 select grade white pine (no knots), 15-in. square in plan, spaced approximately 1¹/₂-in. apart and fastened at right angles with a single nail at each end. The crib shall be conditioned to an average moisture content of 7.5 ± 0.5%. The crib is placed in a rear corner of the crawl space 1-in. from each wall surface and supported approximately 4-in. above the floor on small sections of refractory brick. The crib sticks of the bottom layer shall be parallel to the side walls. Approximately 150-ml of ethyl alcohol in a circular or square metal pan with a surface area of 36 to 40-in² placed under the crib is used for ignition.

A1.2.3 TEST MATRIX

The interior face of the control assembly shall consist of nominal 1/4-inch-thick A-C or B-C plywood applied to the interior face of wood wall framing (plywood is permitted by UBC Section 2602.4, Exception 4, IBC Section 2603.4.1.6 and IRC Section R314.5.3 as a protective material for foam plastic located in attics.) The second test assembly shall be identical, but without plywood on the interior face of the wall..

A1.2.4 TEST DURATION AND END POINT COMPARISON CRITERIA

One or both of the following two criteria are established for test duration and relative comparison to between tests:

1. Time to flames emerging from the front of the crawl space.
2. Time to burn-through of the floor/deck system.

The time to flashover and the time to burn through the wood-framed floor/ceiling must be equal or greater for the exposed foam plastic insulation versus the foam plastic insulation covered with the 1/4-inch-thick plywood.

A1.2.5 DOCUMENTATION

The test is recorded with photographs and video documentation positioned to view the entire front of the open side of the module. A timing reference, mechanical or electronic, is included in all photographic and video records.

A1.2.6 REPORT

The report shall include:

- Name and location of facility where test is conducted.
- A description of the tested assembly with emphasis on the insulation type (including facings), thickness, density, and attachment details.
- Photographic and video documentation: pre-test, during (including timing), and post-test.
- A summary of visual observations including time to flames exiting the module and/or burn through of the sub-floor assembly.

ACCEPTANCE CRITERIA FOR SPRAY-APPLIED
FOAM PLASTIC INSULATION (AC377)

- Conclusions in the form of a statement of findings summarizing the fire performance of the assembly; and, as appropriate, compared to a baseline test.
- Signature of a representative engineer or officer of the test facility.