BioBased Insulation®
Division of BioBased Technologies®

Thermal and Ignition Barriers for Spray Foam Insulation

The building code regulations regarding spray foam insulation and coatings can be tricky if you aren't familiar with the requirements. However, understanding the background and the intent behind the regulations will help you understand how best to approach your specific building needs.

Chapter 26 of the International Building Code addresses the use of Foam Plastic Insulation.

> *Section 2603.3 – unless otherwise indicated in this section, foam plastic insulation and foam plastic cores of manufactured assemblies shall have a flame spread index of not more than 75 and a smoke developed index of not more than 450 where tested in the maximum thickness intended for use in accordance with ASTM E 84 or UL 723. Loose fill-type foam plastic insulation shall be tested as board stock for the flame spread and smoke-developed indexes.*

This section sets limits on the flame spread index as well as the smoke development index. Under the ASTM E 84 standard, only class A and B ratings are acceptable. Today, many commercial foam plastics have achieved these ratings. The key distinguishing factor between these ratings is the allowable flame spread rating for Class A is 25 and for Class B is 75. The smoke development index is the same for both ratings. You may notice that the smoke development index is also relatively high at 450 compared with other insulation materials.

In building fires, smoke inhalation and asphyxiation are the two main causes of fatalities. It is for this reason that foam plastics are held to a higher standard in the building codes than many other products. Many of the stipulations placed on spray foam often seem illogical or overly cumbersome. However, when these regulations are followed foam plastic insulation systems can be safer than traditional insulation systems. These regulations have challenged the foam plastic industry to create better building products.

Prescriptive Thermal Barriers

The key with any foam plastic insulation, be it spray foam or rigid foam board, is to always protect the foam from the occupants or the occupants from the foam in the event of a fire. The main way this is accomplished is by using building materials that are considered thermal barriers. The International Building Code states that foam plastics must be separated from the occupants by a 15-minute thermal barrier.

> *Section 2603.4 Thermal Barrier: Except as provided in sections 2603.4.1 and 2603.9, foam plastic shall be separated from the interior of a building by an approved thermal barrier of 0.5 inch gypsum wallboard or equivalent thermal barrier material that will limit the average temperature rise of the unexposed surface to not more that 250°F after 15 minutes of exposure, complying with the time temperature curve of ASTM E -119. The thermal barrier shall be installed in such a manner that it will remain in place for 15 minutes based on FM4880, UL 1040, NFPA 286, or UL 1715. Combustible concealed spaces shall comply with 717.*

Based on this code section, gypsum wallboard is commonly referred to as a prescriptive thermal barrier. However, other products can be used as prescriptive thermal barriers if they have successfully passed ASTM E 119 as outlined in 2603.4. Some of these products include ¾" OSB/Plywood, URE-K from International Cellulose and Monokote-3306.

Prescriptive Ignition Barriers

In some cases, which are outlined in IBC 2603.4.1, a thermal barrier is not required as long as an ignition barrier is used. Thermal barriers essentially provide a timed rating, ensuring that occupants have at least 15 minutes after fire exposure before foam plastics become involved in the fire. Ignition barriers do not offer a timed rating. The purpose of ignition barriers is to impede the direct contact of a flame to the foamed plastic insulation. There is no specific test method for identifying what constitutes an ignition barrier. However, when the model codes were first developed, several common building materials were listed as prescriptive ignition barriers. These include 1½" mineral fiber or fiberglass, ¼" plywood, ⅜" gypsum wall board, or corrosion resistant steel with a base metal thickness of 0.016 which is approximately 28-30 Gage.

After looking through these exceptions, it may seem a little confusing as to why only an ignition barrier is required in these instances. The most common issue is in attics and crawlspaces. Under IBC 2603.4.1.6, attics or crawlspaces where entry is only for the service of utilities do not require a thermal barrier, but do require an ignition barrier. The key here is that the foam is still separated from the occupants by a thermal barrier (i.e. the ceiling), but the area inside the attic or crawlspace doesn't need the same level of protection since no occupants will enter this space for any extended period of time. It is however necessary to make sure that if a fire starts in this space, it doesn't spread rapidly. Ignition barriers provide this protection.

Non-Prescriptive Thermal Barriers

In addition to the prescriptive thermal barriers that have been discussed, there are test methods that can be used to identify non-prescriptive thermal barriers or approved assemblies. All special approvals (including thermal and ignition barriers) have their roots in the special approvals section of IBC 2603.9. This section basically states that if you want to avoid using a prescriptive thermal or ignition barrier, then the spray foam assembly can be tested. If the assembly is proven to be "safe" then that alternative thermal/ignition barrier can be used or a foamed plastic can be approved without any covering.

> *Special Approval. Foam plastic shall not be required to comply with the requirements of Sections 2603.4 through 2603.7 where specifically approved based on large-scale tests such as, but not limited to, NFPA 286 (with the acceptance criteria of Section 803.2), FM 4880, UL 1040 or UL 1715. Such testing shall be related to the actual end-use configuration and be performed on the finished manufactured foam plastic assembly in the maximum thickness intended for use. Foam plastics that are used as interior finish on the basis of special tests shall also conform to the flame spread requirements of Chapter 8. Assemblies tested shall include seams, joints and other typical details used in the installation of the assembly and shall be tested in the manner intended for use.*

The catch here is that the specific assembly must be tested. ASTM E 119 tests the fire resistance of the covering where as the large-scale tests look at the full assembly. This means that a non-prescriptive thermal barrier which complies with one of the test methods listed 2603.9 over brand X foam is not also approved over brand Y foam. Brand Y must also be tested in the same assembly.

Non-prescriptive Ignition Barriers

The tests indicated in IBC 2603.9 are all test methods used to examine thermal barriers. When the building codes were written, there were and still are no small-scale test methods which can be used to approve non-prescriptive ignition barriers. In 2000, ICC-ES began issuing evaluation reports for spray foam systems without ignition barriers and with non-prescriptive ignition barriers based on a large-scale test method that was introduced by South West Research Institute called SwRI 99-02. However, over the past few years there have been significant changes to the ICC building codes as they relate to the testing procedures used for foam plastic insulation in attics and crawlspaces. A summary paper of these changes is available.[1] All product approvals based on SwRI 99-02 tests using a fiberglass baseline or comparative NFPA 286 tests are no longer valid. Instead, products must be tested using either a modified NFPA 286 test as outlined in ICC-ES AC-377 Appendix X or for crawlspaces only, a comparative SwRI 99-02 test using a plywood baseline.

The good news is that the treatment options and the conditions of use for foam plastic insulation have been simplified. This will result in lower liability due to improperly applied products and confusion among builders, architects, code officials and contractors. Building owners and occupants will benefit from the increased safety provided by these more stringent building codes.

Based on the changes to ICC-ES AC-377[2], BioBased Technologies® updated its recommendations for use of BioBased Insulation® products within attics and crawlspaces. These new changes are reflected in an updated ICC-ES report and product Technical Data Sheets for all BioBased Insulation® products and are summarized here for our most popular products.

BioBased 501w®

BioBased 501w® is a 0.5 lb density open cell, spray polyurethane foam. When installed in applications that need a thermal barrier, BioBased 501w® can be used with a standard ½" gypsum prescriptive thermal barrier. However, this product can also be covered with 30 wet mils of Flame Seal TB. Flame Seal TB is an advanced intumescent paint product that has been tested with BioBased 501w® in a UL 1715 test as identified in IBC 2603.9.

In addition to the prescriptive ignition barriers previously discussed, Flame Seal TB intumescent paint has been approved as an non-prescriptive ignition barrier over BioBased 501w®. At 3 mils thickness, this represents the thinnest, most cost effective non-prescriptive ignition barrier in the industry to date.

Depending on the thickness used, these two options make Flame Seal TB an ideal intumescent coating for spray foam contractors. It allows contractors to stock one product that fits multiple needs. For more information on this product, contact Flame Seal at http://www.flamesealtb.com

2001NB

In some cases, closed cell foam insulation products are desirable because of their increased R-value where the assembly thickness is limited. In addition, closed cell foams can act as a Class II vapor retarder at a depth of approximately 2". For this reason, BioBased Insulation® offers 2001NB. This non-biobased 245fa-blown, 2.0 lb density closed cell foam offers one additional advantage. This product has passed the modified NFPA 286 test as designated in ICC-ES without any coverings. This allows the product to be installed in applications that require a prescriptive ignition barrier with out any coverings. However, 2001NB will still require a prescriptive thermal barrier in areas that will be exposed to building occupants.

1 Sheldon, M., Beitel, J., Duncan, R., *New Fire Test Method for Ignition Barrier Alternatives in Attics and Crawlspaces*, CPI Technical Conference October 2009

2 *Acceptance Criteria for Spray-Applied Plastic Insulation AC-377*, ICC Evaluation Services, Inc.,Effective Date November 1, 2010

Additional Details

CADDs which detail various wall and roof assemblies using both BioBased 501w® and 2001NB have been included in Appendix A. In addition, there are three design considerations to keep in mind:

1) BioBased Technologies® does not recommend nor endorse open combustion appliances located within a conditioned attic or crawlspace assembly. These types of appliances are less energy efficient than their closed combustion cousins and in some cases can present significant safety hazards such as carbon monoxide exposure and flame roll out when located within a conditioned attic or crawlspace. If these appliances are used, BioBased Technologies® recommends locating these appliances within a mechanical closet with combustion air supplied in accordance with IMC Chapter 7.

2) In its strictest interpretation, an attic or crawlspace area with storage for household items will be used for access other than "the service of utilities" as defined by IRC 315 and IBC chapter 26. Therefore foam plastics located with the "storage" area of an attic must be protected by a 15-minute thermal barrier. In this instance, the application of Flame Seal TB™ at the appropriate thickness may be the best course of action instead of ½" gypsum wall board.

3) When using an intumescent coating, especially as a thermal barrier in occupied spaces, it is important to protect the coating. Coatings can be damaged or punctured by bumps. In areas where damage may occur, a prescriptive thermal/ignition barrier should be used.

About The Author

Chris Porter is the technical manager for BioBased Insulation®, the Insulation and Sealant Division of BioBased Technologies®. Chris began his career in the spray foam industry as a spray foam contractor. He is active on several industry committees focused on technical and product stewardship issues.

If you'd like to include BioBased Insulation® in your architectural reference library, a complete architectural manual is available for free from BioBased Insulation® by e-mailing your request and mailing address to info@biobased.net.

Appendix

BioBased Insulation®
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BIOBASED INSULATION ® - A DIVISION
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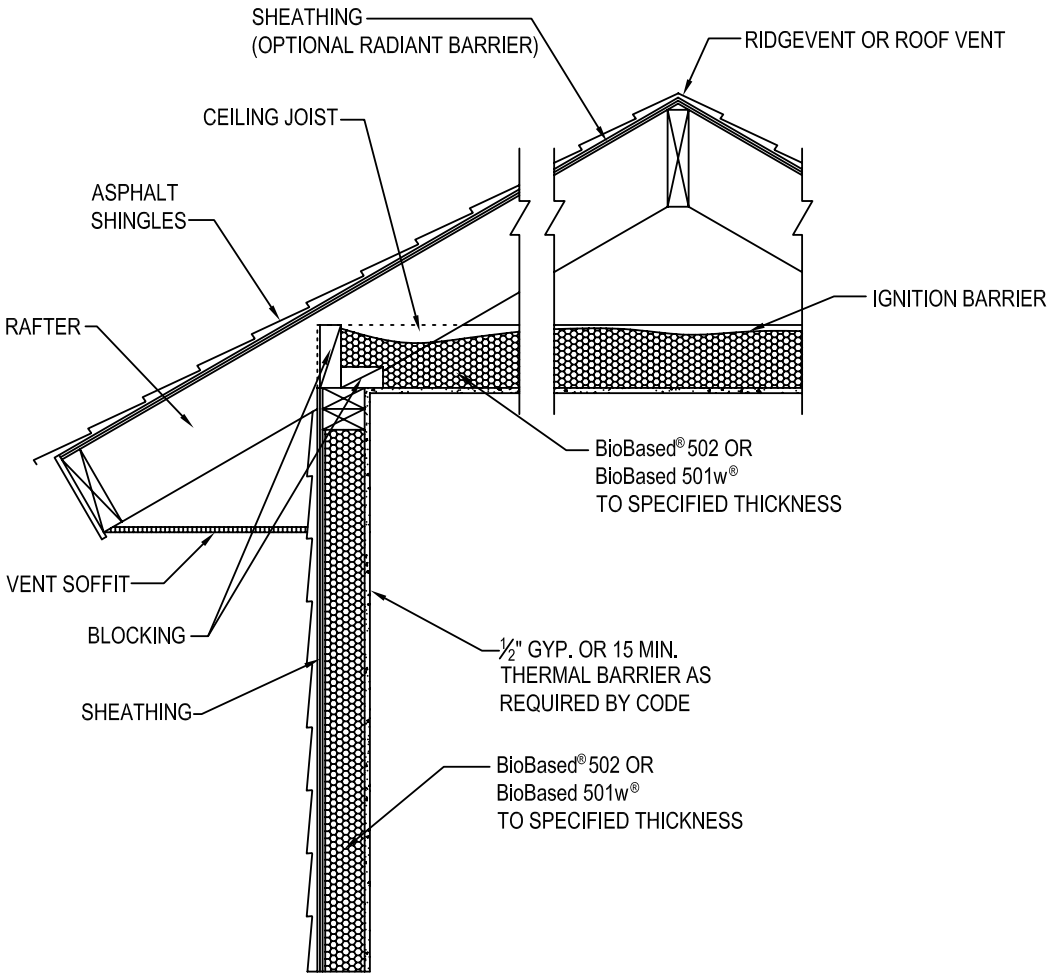
OPEN CELL FOAM TRADITIONAL CEILING DETAIL



NOTES:
1. INSTALLATION TO BE COMPLETED IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS.
2. ALL DIMENSIONS ARE CONSIDERED TRUE AND REFLECT MANUFACTURER'S SPECIFICATIONS.
3. CONTRACTOR'S NOTE: FOR PRODUCT AND COMPANY INFORMATION VISIT www.CADdetails.com/info
   REFERENCE NUMBER 2314-015.

APPLICATION DETAILS

TRADITIONAL CEILING DETAIL - OPEN CELL

2314-015

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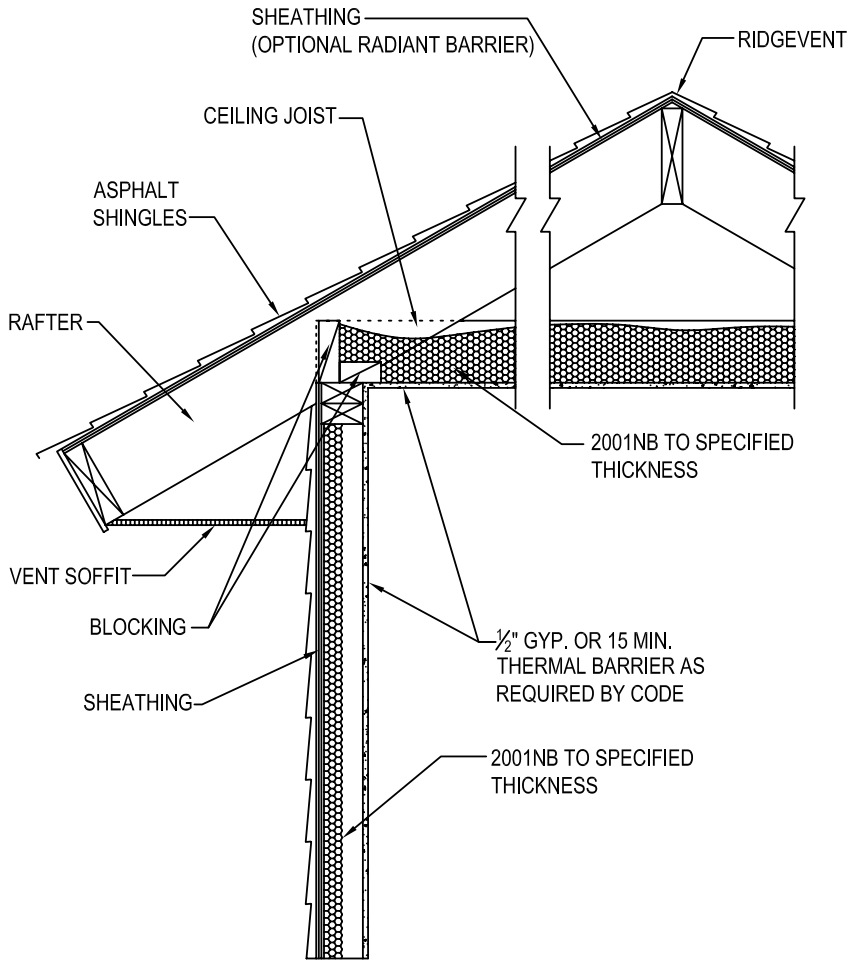
CLOSED CELL FOAM TRADITIONAL CEILING DETAIL



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APPLICATION DETAILS

TRADITIONAL CEILING DETAIL - CLOSED CELL

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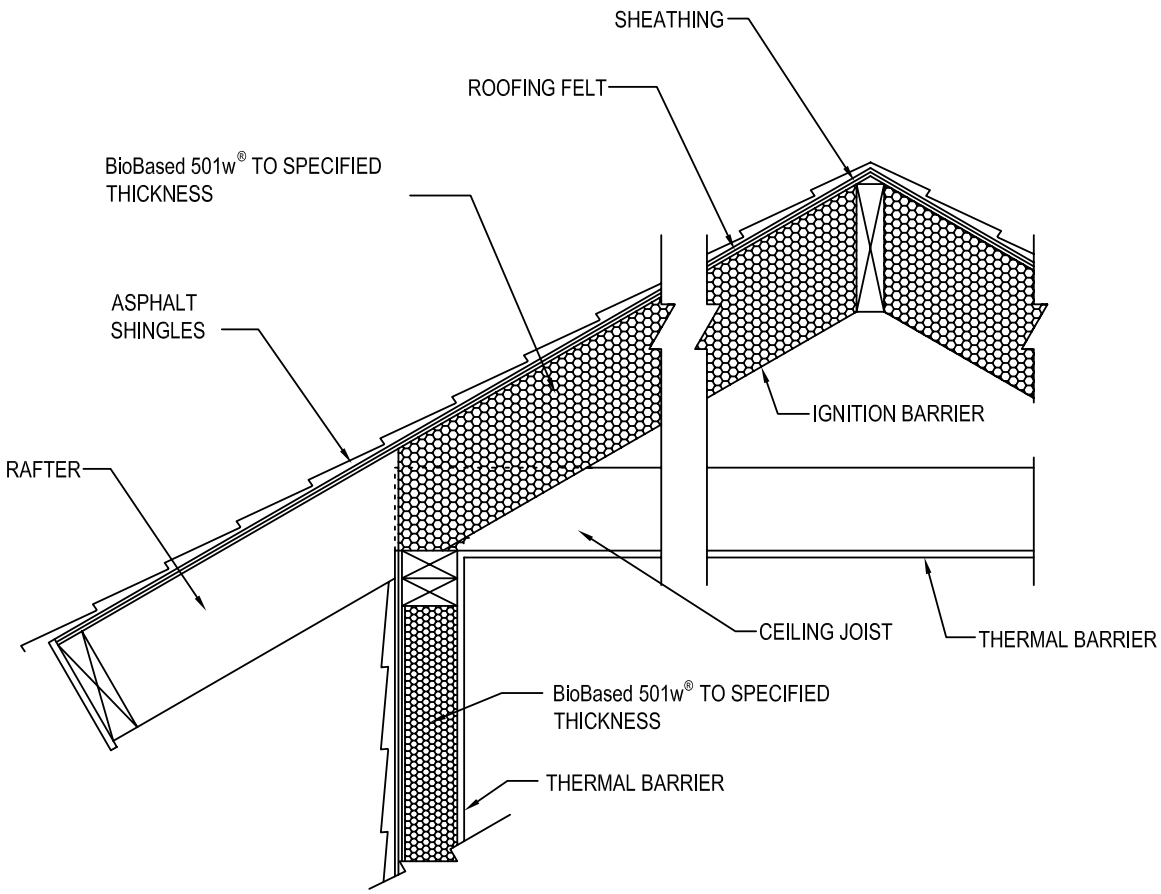
NON-VENTED ATTIC DETAIL-OPEN CELL



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APPLICATION DETAILS

NON-VENTED ATTIC DETAIL - OPEN CELL

2314-012

REVISION DATE 11/08/2011

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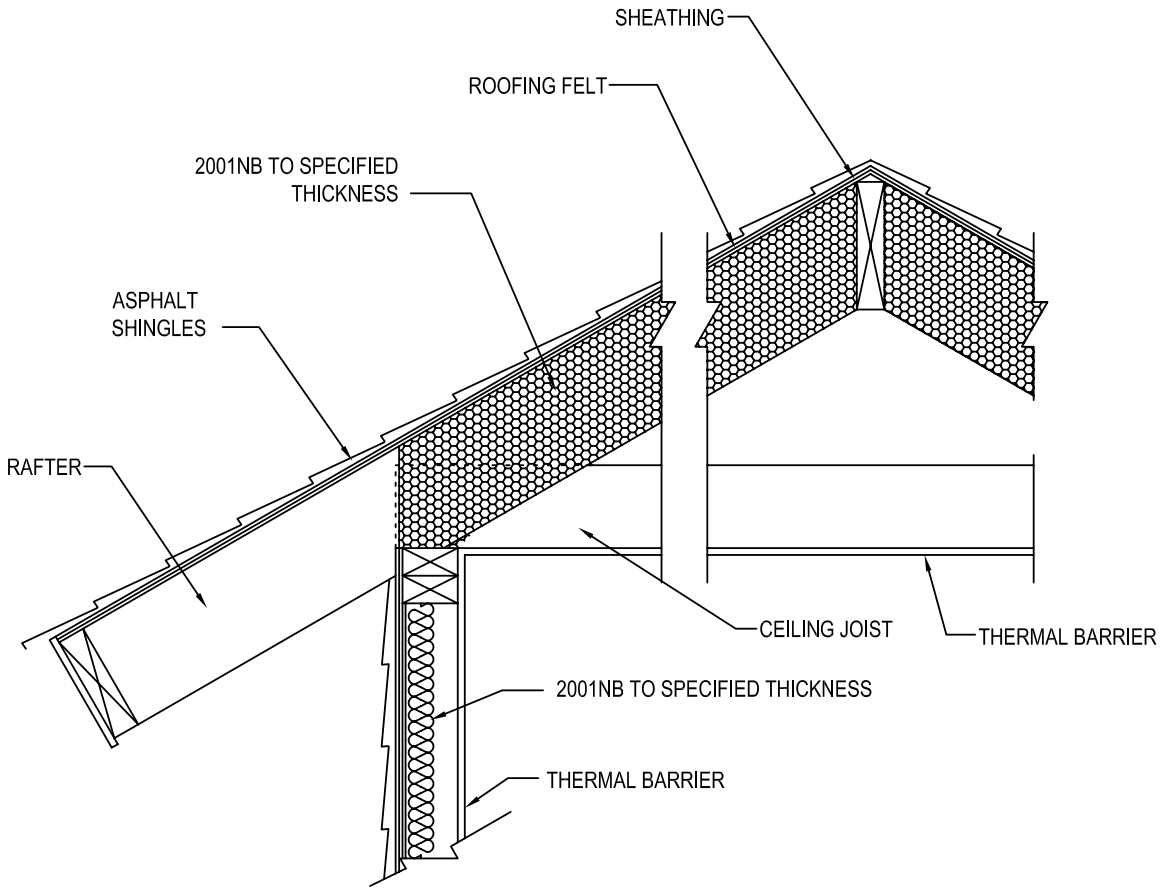
NON-VENTED ATTIC DETAIL - CLOSED CELL



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NON-VENTED ATTIC DETAIL - CLOSED CELL

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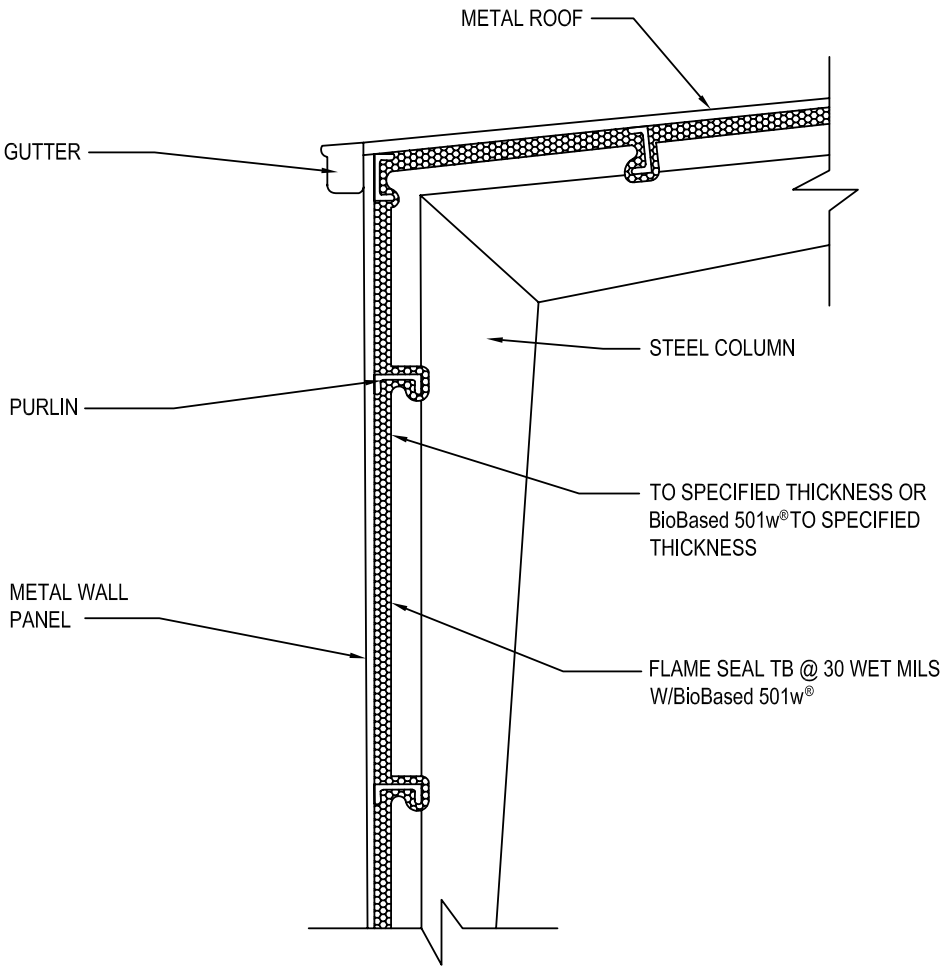

NOTE:
IN AREAS BELOW 8' OR WHERE FOAM AND COATING MAYBE DAMAGED, PROTECT WITH 1/2" GYPSUM OR OTHER APPROVED 15 MINUTE THERMAL BARRIER.

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3. CONTRACTOR'S NOTE: FOR PRODUCT AND COMPANY INFORMATION VISIT www.CADdetails.com/info REFERENCE NUMBER 2314-022.

APPLICATION DETAILS

METAL BUILDING DETAIL

2314-022