RECOMMENDATIONS WHEN APPLYING SPRAY POLYURETHANE FOAM INSULATION ON AND AROUND PLASTIC PRESSURE PIPES & FITTINGS

PPI TN-69

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Plastics Pipe Institute
The Voice of an Industry.

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Foreword

This technical note was developed and published with the technical help and financial support of the members of the Plastics Pipe Institute (PPI). These members have shown their commitment to developing and improving quality products by assisting standards development organizations in the development of standards, and by developing design aids and reports to help engineers, code officials, specifying groups, contractors, and users.

The purpose of this technical note is to provide information regarding the use of spray polyurethane foam insulation around plastic water distribution pipes.

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1.0 INTRODUCTION

Plastic pressure pipes and fittings are commonly used in applications such as hot- and cold-water plumbing, fire protection, and hydronic heating and cooling systems, including radiant distribution systems. In certain instances, pipes and fittings are installed inside areas that must be insulated, such as within a ceiling or wall cavity. In other cases, the pipes and fittings themselves must be insulated to reduce the transfer of heat through the pipe wall.

This Technical Note provides guidance about proper application of spray polyurethane foam insulation to avoid damage due to **excessive heat** surrounding the following types of plastic pressure pipe, tubing, and fitting materials:

- CPVC: *chlorinated polyvinyl chloride*
- PEX: *crosslinked polyethylene*
- PEX/AL/PEX: *crosslinked polyethylene/aluminum/crosslinked polyethylene*
- PERT/AL/PERT: *polyethylene of raised temperature resistance/aluminum/polyethylene of raised temperature resistance*
- PE-RT: *polyethylene of raised temperature resistance*
- PP-R: *random copolymerized polypropylene*
- PP-RCT: *polypropylene random copolymer with modified crystallinity & temperature resistance*
- PSU: *polysulfone*
- PPS: *polyphenlysulfone*
- PPSU: *polyphenylene sulfide*
- PVDF: *polyvinylidene fluoride*

Much of the information in this document is provided by the Spray Polyurethane Foam Alliance (SPFA) which is an excellent source of knowledge of these types of insulation products and proper installation in numerous applications. *https://www.sprayfoam.org/*

This document does not address required insulation values for pipes in various applications. For that type of information, please see PPI TN-65 *Insulation Recommendations for Plastic Pressure Piping Materials in Residential Applications.*

NOTE 1: This document does not apply to other types of spray foam such as that used for fireblock or firestop.

2.0 SPRAY POLYURETHANE FOAM INSULATION - GENERAL

According to the Spray Polyurethane Foam Alliance (SPFA), Spray Polyurethane Foam, or SPF, is a high-performance insulation material commonly used in homes and buildings of all types. SPF insulation is the only insulation inside stud walls that can provide R-value, air barrier, and vapor retarder* in a single product. SPF insulation can be used in virtually any location within the residential building enclosure.
**Only closed cell foam products serve as Class II vapor retarders*

SPF has been used as insulation in homes and buildings for decades.

The spray polyurethane foam curing reaction is exothermic, which means that heat is generated during the foam reaction. The heat of reaction is highly dependent on the SPF formulation and is also based upon the overall intended application or lift (i.e., layer) thickness installed. Peak temperature within the layer of foam typically occurs within 5 - 15 minutes of application, followed by gradual cooling.

3.0 SPRAY POLYURETHANE FOAM INSULATION – TEMPERATURES WHEN CURING AND THE RISKS TO PLASTIC PIPE & FITTING MATERIALS

According to documents published by the SPFA, “The chemical reaction that takes place during the application and curing of SPF will generate exothermic temperatures above the 120°F - 130°F [49°C - 54°C] setpoint temperatures of the proportioner and hoses. Peak temperatures at the mid-thickness of a pass can exceed 200°F [93°C] for several minutes and reach peak temperatures 250°F - 275°F [121°C - 135°C] for a minute or two, especially for closed-cell SPF, when applied at the maximum pass thickness.”

“An example of measured exothermic temperatures for a closed-cell SPF product using an HFC blowing agent applied to a heated sheet metal substrate is shown in **Figure 1**.”

“It should be noted that newer closed-cell SPF formulations using HFO blowing agents may use different catalysts, which, in some foams, can increase the peak temperatures during curing to as high as 325°F [163°C] for short periods and can delay the time to reach the peak temperature.”

NOTE 2: HFC = “hydrofluorocarbon” and HFO = “hydrofluoro-olefin”

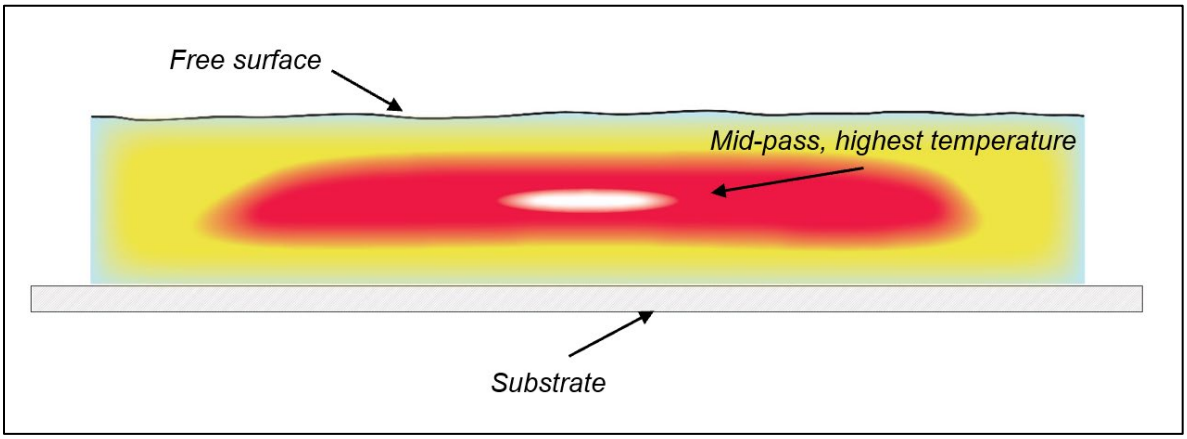

Figure 1: Illustration of typical temperature distribution within a layer of spray polyurethane foam insulation

Plastic pipes and fittings in both residential and commercial plumbing, residential fire protection, and most hydronic applications are typically required to have pressure ratings at 180°F (82°C) operating temperature. Pipes approved for such applications will have their operating pressure at 180°F included in the pipe markings.

The plastic pipes included in this Technical Note (e.g., CPVC, PEX, PE-RT, PP {PP-R and PP-RCT}) will withstand short-term exposure to temperatures above 180°F. However, exposure to temperatures above the rated operating temperature of each material, which may occur if pipes are encased in a thick lift of SPF, are likely to have negative effects on these plastic pipe materials, potentially leading to premature failure.

See Section 4.0 for recommended installation methods to prevent exposure of plastic piping materials to excessive temperatures.

4.0 RECOMMENDATIONS FOR SAFE INSTALLATION OF SPF ON AND AROUND PLASTIC PIPING MATERIALS

SPFA recommends that when there are plastic pipes in a wall, ceiling, or floor cavity, the SPF installer should apply one layer of foam until it touches the pipe but **does not encase the pipe**. See **Figure 2a**.

SPF installers should let the first layer of foam cure for a sufficient amount of time while the heat is released and the pipe remains partially exposed. Typically, this is when the surface of the SPF has cooled to approximately 100°F (38°C). Then, they may apply the second layer or lift. This way, the pipe is never in the middle of a thick layer of foam insulation during curing. See **Figure 2b**.

Correct Installation

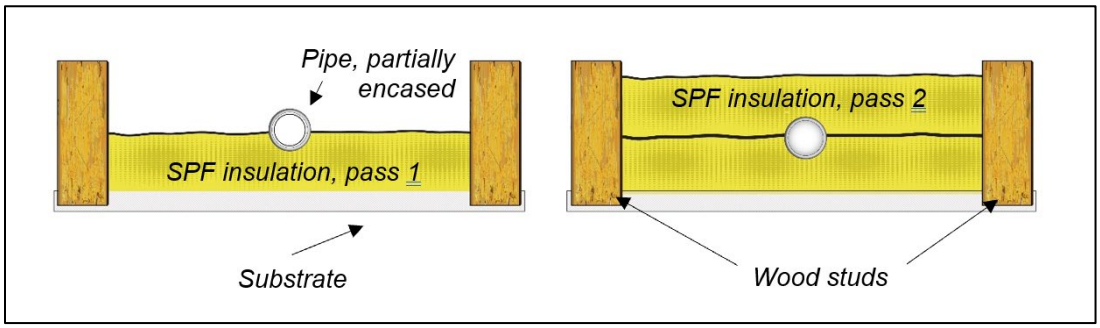

Figure 2a (left) and 2b (right): The first layer of SPF insulation is stopped when it reaches the pipe, just barely touching or encasing it, but keeping portions of the pipe exposed. After sufficient cooling time, the second layer of SFP insulation is sprayed over the pipe to the required thickness. If pipes are installed at different depths, continue this process for each depth of pipe.

This is the correct procedure.

To avoid excessive temperatures, **Do Not** encase plastic pipe and fittings in a single pass of SPF. **See Figure 3**.

Incorrect Installation

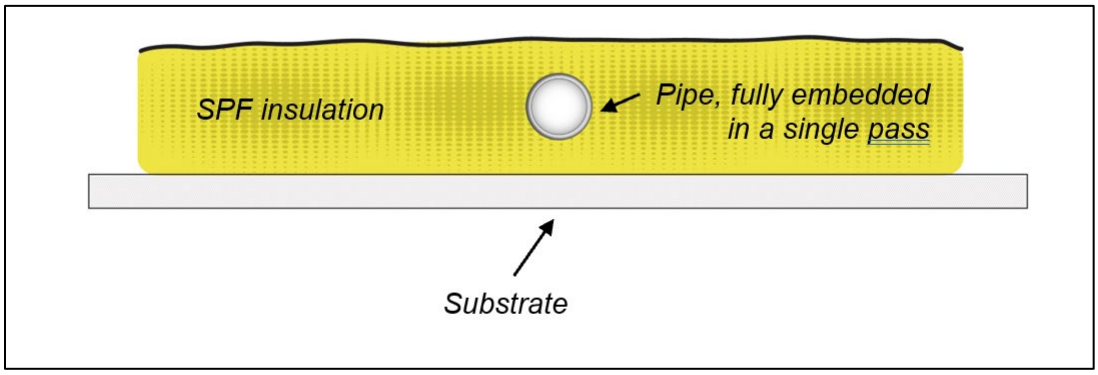

Figure 3: Installation of pipes and fittings within a single pass of SPF is not permitted as the temperature within the foam may exceed the capabilities of the pipe and damage pipes or fittings.

A pressurized pipe, if overheated, could soften and deform and potentially burst, whereas an unpressurized pipe will not burst. Therefore, PPI recommends that installed pipes are **de-pressurized** when encased in spray foam. Pipes should be drained and a **valve must be opened** to ensure the line is depressurized before the foam is applied and during its application and curing.

Pipes may contain air but must not be pressurized with air during the SPF application. Piping installers must ensure all plastic pipes are not pressurized.

NOTE 3: While it is not the focus on this Technical Note, plastic pipe materials (e.g., CPVC, HDPE, PEX, PEX-AL-PEX, PE-RT, PP-R, PP-RCT) are not known to have chemical-compatibility issues with properly mixed and applied spray polyurethane foam insulation. In fact, many piping manufacturers sell pre-insulated pipes which are encased in SPF.

When two-component foams are improperly mixed and there is an excess of either component present on the pipes or fittings or when the material fails to foam, compatibility problems may arise from the unreacted excess or additives of either component being left in contact with the pipe or fittings.

In case of any questions about potential chemical-compatibility issues with spray foam insulation or its components, installers of spray foam products should contact the pipe manufacturer and review **PPI TR-19** ***Chemical Resistance of Plastic Piping Materials***.

NOTE 4: Certain plastic fitting materials (e.g., PSU, PPSU) may be incompatible with spray foam insulation and might have chemical-compatibility issues if the fittings are encased directly in SPF. Completely wrapping the fittings in aluminum foil or other approved methods prior to foam application, to provide a chemical barrier, may be a solution. CPVC and PP fittings are not known to have such issues. Consult the fitting manufacturer to confirm chemical compatibility and the appropriate use of any protective materials.

5.0 CONCLUSION

The installation of spray polyurethane foam insulation on or around plastic pressure piping is typically acceptable when allowed by the pipe and fitting manufacturer and when the SPF installer strictly follows the recommendations of this Technical Note and the installation recommendations published by the Spray Polyurethane Foam Alliance. *https://www.sprayfoam.org/*