

PPFA User Bulletin

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User Bulletin 16: Building Codes & Plastic Piping

BUILDING CODES & PLASTIC PIPING

Introduction

The focus of this User Bulletin is the building code provisions that apply to plastic piping as a combustible material. Plastic piping is now being used in many commercial and residential buildings. The applications range from basic sanitary waste and vent systems, roof drains, and hot/cold water distribution to specialized systems such as hydronic heating, fire sprinklers, and chilled water systems. Because plastic piping represents a very small portion of the combustibles within these buildings, no evidence of need for special tests or requirements other than those that are described below has been found. Since plastic pressure piping is filled with water and uses smaller pipe sizes, combustibility is less of an issue than with gravity-flow systems.

This User Bulletin addresses the issue of how building code provisions relating to the use of combustible materials are being applied to plastic piping. It includes the latest information about ASTM E 84 tests and shows how plastic piping can meet the 25/50 FS/SD requirements for use in plenums.

Building Code Requirements

The current editions of all national building, plumbing and mechanical codes permit the use of plastic pipe in all types of construction. Also, there are no building height limitations restricting the use of plastic pipe. All of the model building codes (National Building Code, Standard Building Code, Uniform Building Code, International Building Code), as well as most local building codes, contain fire safety requirements that regulate building assemblies (barriers) based on their resistance to fire and combustible materials based on their surface burning characteristics.

In these codes, the structural building assemblies and the fire barriers are evaluated using ASTM E 119 - *Test Methods for Fire Tests of Building Construction and Materials* and their “fire resistance ratings” are established. For other building components and materials, such as interior trim, wall coverings, interior finish and the materials exposed in plenums, the codes reference ASTM E 84 - *Test Method for Surface Burning Characteristics of Building Materials*.

ASTM E 119 and Fire Barriers

As buildings became larger, provisions were added to the codes to contain any fire within a limited area and to prevent it from spreading vertically or horizontally. This is accomplished by establishing requirements that certain wall, floor, and floor-ceiling assemblies have “fire resistance ratings” of 1 to 4 hours. The rating of a barrier is established by subjecting a sample assembly (wall, floor or floor-ceiling unit) to the ASTM E 119 fire conditions in a “furnace” designed and built so that the time/temperature and furnace pressure conditions can be developed, controlled, and recorded. Listings of Fire Resistance Ratings for a wide variety of building materials, walls, floors and floor-ceiling assemblies are published by several agencies.

NOTE: *This PPFA User Bulletin is designed to provide guidance in achieving the efficient, effective and proper use of plastic pipe. The suggestions and advice contained in the Bulletin are offered merely to provide plastic pipe users with a general frame of reference. Because specific situations may and often do require special treatment, the suggestions and advice are obviously not universally applicable. Therefore, the user should carefully assess the requirements of his specific situation before making practical application of anything contained in this publication.*

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As plastic piping applications increased, a modified version of the ASTM E 119 Test Method was developed. This focused on the issue of evaluating the fire resistance of a plastic pipe penetration of a fire-rated barrier. ASTM E 814 - *Test Method for Fire Tests of Through-Penetration Fire Stops* was developed, and it differs from ASTM E 119 by using a smaller wall or floor assembly so the focus is on the plastic pipe and the *Fire Stop*. The “*Fire Stop*” can be a device or a system that includes specific and proprietary materials installed in a prescribed way to provide a certain level of fire resistance. Numerous ASTM E 814 tests have been done, and the resulting ratings are published in the Listings of Fire Resistance Ratings of several agencies.

In addition, the PPPFA manual, *Plastic Pipe in Fire Resistive Construction*, provides a good overview of plastic pipe fire testing along with a listing of ASTM E 814 test results organized by plastic pipe material. It shows ASTM E 814 F and T (Flame & Temperature) ratings plus some ratings for certain *Fire Stops* based on the higher positive furnace pressure required in the Canadian Building Code. The manual also indicates which “fire stops” are manufactured devices and which ones are penetration-sealing systems. These publications (the aforementioned listings and the PPPFA manual) provide the information needed to properly design and specify plastic piping system installations in fire rated buildings while fully meeting the building code requirements.

ASTM E 84 and Building Codes

ASTM E 84 was developed to measure the flame-spread characteristics of flat surface materials. In this test, the product sample is mounted on the ceiling of a tunnel-type test chamber, and it is subjected to a test flame for a specific period of time, while controlled airflow through the tunnel causes the flame to travel along the specimen. There are windows along the side of the tunnel to observe the flame travel along the length of the 24-foot long sample. The flame travel distance and the amount of smoke produced are measured and recorded. These results are then assigned values based on a comparison with a reference combustible material (red oak) and a non-combustible material (asbestos-cement board). The two reference materials have been assigned FS/SD (Flame Spread/Smoke Developed)** values of 100/100 for red oak and 0/0 for the asbestos-cement board.

The building codes have several categories of FS/SD ratings that must be met by materials (or products made from those materials) depending on the building’s fire rating, its occupancy, its size, and even the inclusion of a fire sprinkler system. For example, the most stringent interior finish requirements call for materials that have FS/SD values of 25/100 or less. Other sections allow for FS values as high as 75 and SD values as high as 450. Because most piping is within walls or pipe chases, it is protected from fires that originate in occupied spaces. Therefore there are no specific references to plastic pipe FS/SD requirements. However, when it is used in a plenum, it qualifies as an “exposed material.” (See below)

The 1997 UBC has the following FS/SD references:

- 601.5.5 Interior trim 75/xx
- 707.2 Pipe insulation 25/450
- 707.3 Insulation 25/450
- 2602.3 Foam plastic 75/450
- 2602.5.2.1 Foam insulation 75/450
- 2602.5.2.2 Foam plastic 75/450
- 2605.5.5 Garage doors 75/450
- Exposed materials in plenums 25/50

Plenums and Plastic Piping

In all building/mechanical codes FS /SD (25/50) is the basic requirement for materials exposed in plenums. In addition, most codes include a list of *Exceptions* for products that have been accepted for use in plenums based on tests of the product “as used.” There are three “product specific” tests that are listed under this provision: the UL 910 Test for Plenum Cables, the UL 1887 Test for Plastic Fire Sprinkler Pipe, and the UL 1820 Test for Pneumatic Tubing.

ASTM E 84 tests conducted at Southwest Research Institute (SwRI) have shown that PVC and ABS waste system and roof drain pipe covered with 1” thick preformed pipe insulation meeting the requirements of ASTM C 547 Type 1 or 2 will meet the 25/50 FS/SD limits.

Summary

The building and mechanical code provisions that are based on fire safety apply to plastic piping in two ways. Through-penetration fire stops are required for plastic pipe penetrations of the fire-rated barrier walls wherever these barriers are required by the building code. Wherever plastic piping — roof drain or drain, waste and vent — is exposed, as in a plenum, the piping must be covered by an insulation that has been tested to show that the insulated piping as installed meets the ASTM E 84 FS/SD requirements of 25/50.

*** Many codes have changed the FS/SD term to FSI/SDI (Flame Spread Index/Smoke Developed Index) because there are no standard units of measurement for the numbers used.*

(Author's note: A code change proposal has been submitted to establish this as a listed exception under the Plenum requirements. This needs to be adjusted when the code change is approved.)