

Technology Update

Understanding The T Rating

Taking the mystery out of firestopping's misunderstood and often misapplied rating.

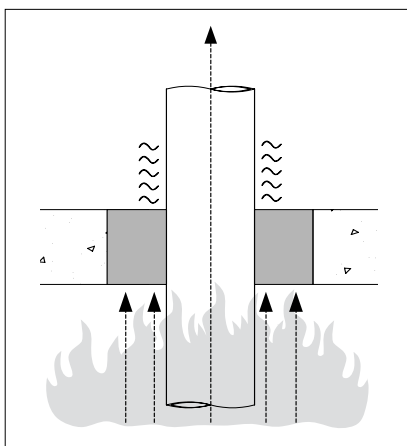
FIRESTOP systems tested to ASTM E814 (UL1479) have two ratings. The F Rating represents a minimum amount of time that an installation has been tested and shown to prevent the propagation of fire. Most people can readily understand this portion of the rating. The T Rating, however, is a different and more complicated story. The T Rating is often disregarded or overlooked.

By definition it is a measure of the time it takes for any thermocouple on the unexposed side (the side of the assembly away from the fire) to reach a temperature 325°F above the temperature of this thermocouple prior to the start of the test. Thus it is a measure of thermal conductivity.

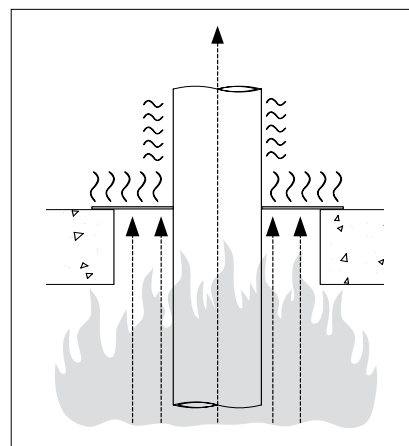
ASTM E814 was developed in the early 1980's to address the need for a test to specifically address the needs of firestopping. Prior to this standard, unofficial variations of ASTM E119 were used to evaluate firestop methods and materials. This test however, was designed to evaluate the fire resistive properties of walls and floors and if followed to the letter of the law—tended to be too restrictive in its requirements concerning thermal conductivity. The limitations it prescribed made it practically impossible to penetrate a rated barrier with a metallic penetrant.

E814 Made T Ratings Optional: ASTM E814 was written in a fashion that would let the question of thermal conductivity become an option. Temperatures would be monitored and recorded but would be reported separately from the F rating. Thus the T rating was born. What the members of this ASTM committee couldn't address in this standard, was the

Putting The T Rating To Work



High T Rating Base System: Fire is kept further away from the top plane of the firestop. Thermal conductivity and radiation are limited to the penetrant.



Low T Rating Base System: Fire penetrates the cavity into the floor. Thin panel provides little thermal protection. Pipe becomes hotter. Conductive and radiating surfaces dramatically increase.

method of utilizing this useful bit of information. It has become a political football in code circles being punted back and forth by special interests groups.

The Intent of the T rating: It is important to understand the intent of the T rating. ASTM E119 requires a random placement of thermocouples but specifically requires in addition to these, the placement of thermocouples at any point which might logically be a point of excessive heat transfer. Thus a metallic fastener or a steel beam penetrating on the unexposed side would require a thermocouple. The standard in most cases, provides a limiting temperature rise of 250°F on average but provides an additional 75°F margin for any single thermocouple. Thus that wall with the beam mentioned above, could have a 250°F rise on the wall itself and 325°F on the beam. This was the logic being carried over into ASTM E814.

The E814 committees essentially recognized that penetrants could and would run hotter than the 250°F rise and applied the E119 exception language to the penetrant. The requirements were intended to create some breathing space for the penetrant, not for the firestop seal or the surrounding construction. Thus, if a 6" steel pipe is penetrating a 12" hole, the intent is to allow some margin for the pipe itself.

Consider the Firestop Without the Penetrant: It is easier to consider the issue without a penetrant. Many codes used firestopping language that required walls that were penetrated to be restored to their previous rating. While many people might consider this wording to be vague, it is actually very explicit, if considered with regards to the applicable standards. If a rated barrier had an opening without a penetrant (where one had been removed or not installed in the first place) the sealing requirement would be more obvious. It wouldn't make sense to permit this gap in the wall to have any lesser rating than the wall or floor itself.

Penetrants themselves (and not the surrounding opening) are thus the intended exception to the rule. Firestops should be constructed so that the removal of the penetrant or the decision to omit a penetrant, leave the wall or floor and its required rating intact.

Weak Firestop T Ratings Increase the Potential for the Spread of Fire: Frequently, we see openings created that are far larger than required for the penetrant that has been installed. This may be done to allow expansion of building services at a later date, other times its a matter of poor planning or workmanship. For whatever reasons, it is a common occurrence. It is important to minimize the heat conducted through the barrier and to minimize the amount of hot surface areas. This minimizes the potential of the fire spreading due to conduction and also reduces the potential for combustibles to come in contact with these hot surfaces. Firestop systems that inadequately reduce the heat transfer in the area surrounding the penetrant greatly increase the potential for the spread of fire by the conduction of heat and the increased amount of radiating surfaces.

Testing the Complete System: Thus a properly designed firestop system must not only have the demonstrated ability to perform as a fire barrier with the intended penetrants, but must also have the demonstrated ability to provide the same level of fire resistance including thermal resistance properties as the wall or floor itself. Some special interests groups advocate testing of the sealant only and claim that penetrants that are noncombustible need not be included in firestop testing. Since these penetrants themselves have the potential to thermally damage the sealing material or may expand and fracture more brittle sealing materials, their inclusion is a must.

Composite Panels Offer Weak T Ratings: The UL Fire Resistance Directory shows a number of systems that utilize metallic backed composite panels. These panels are bolted to the top or bottom or both sides of floors or walls in various systems. While fastening these panels to both sides of walls or floors improves T ratings, and placing insulation in between furthers improves the ratings, the fact is that in most field applications, these panels are applied to one side of floor applications only. Frequently the installer cannot access both sides of the installation or simply because of the additional cost, he elects not to install the additional material. When used in this fashion, these panels provide little thermal protection and carry a 0 T rating (about the same as a bare metal sheet).

Combustible penetrants sealed with a single layer of a composite panel may be exposed to temperatures high enough to potentially reignite them. Installations involving combustible penetrants become especially critical in these cases.

Complete System Protection from STI: STI engineered firestop systems are designed to provide the thermal protection originally intended by this standard. Sealant and mortar base designs have been engineered to provide a minimum of 2 hour T Ratings (and in most cases 3 hours) in their base form (when tested without penetrants). This insures that heat transfer is for the most part limited to the penetrant itself. It also assures that these systems can easily be restored if the penetrant is removed, to the rating of the floor or wall, without the need to redesign and replace the seal. STI engineered devices for combustible penetrants provide exceptional T ratings even with the penetrants in place.

The STI approach to firestopping is to develop base systems (systems without penetrants) that afford the same level of protection as the barrier in which they are to be installed. This method assures that penetrants become the exception just as the standard intended. It also minimizes the potential for modifications or retrofits to seriously degrade the seal.

Read the Standards... The committees who developed ASTM E119 and ASTM E814 showed great wisdom in the development of these standards. The challenge for code officials and inspection authorities is to apply the same wisdom in legislating the interpretation and application of these standards. The challenge for firestop product manufacturers is to develop products that support these standards with safe, logical, economical, and easy to install systems. We encourage interested parties to review these two standards. It is important to read ASTM E119 first in order to understand the original intent of ASTM E814. ASTM E814 builds upon the requirements of ASTM E119 and tailors them more specifically to the issue of firestopping.

