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12 common deficiencies found during Firestopping Inspections

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Introduction

This paper will explore the most commonly encountered deficiencies in firestop installation and associated consequences, with the hope that a better understanding of the importance of these issues will result in an increased attention to detail. Firestopping may be a very small portion of the overall building construction, but if overlooked or installed incorrectly, can lead to premature fire and smoke spread, needlessly increasing the risk of injury, death or property loss. Nevertheless, there is a myriad of other factors within a building that will also help or hinder fire and smoke spread, some of which can have a much greater effect, depending on the circumstances. All other fire protection details in a building should be designed, installed and maintained with an equal attention to detail, given that any one inadequate element can become the dominant factor in the results of a given fire.

Significant cost and effort go into building a fire resistance-rated wall or floor. These rated walls and floors will inevitably have a seemingly endless number of breaches in them to accommodate needed utilities. It is a shame and a waste to risk compromising the fire and smoke resistance of the entire wall or floor by getting the last few details – the firestopping of these breaches - wrong. The firestop technology does exist, if correctly applied, to prevent these breaches from creating a weak point.

Improper or ineffective firestop installation can be traced to many sources. Sometimes, the errors start right at the beginning, with improper specification. More frequently, the deficiency can be traced to improper installation. Finally, inadequate or non-existent inspection of the installed work squanders the last remaining chance to catch the errors and make things right. Some may feel that most of the errors enumerated and elaborated on below would be obvious. However, their frequent reoccurrence illustrates the need to better educate specifiers, installers and inspectors.

In trying to instill an understanding and appreciation of why certain details are important and should not be neglected, the anticipated fire behavior of the installations explained to be “inadequate” will be discussed. It should be noted that these anticipated behaviors are not necessarily based on specific and identifiable fire tests, where one variable was changed from the “adequate” to the “inadequate” configuration and the testing redone. As such, this paper does not provide tables of fire test results or references to such results. Rather, the anticipation of how certain details will influence fire behavior represents general trends gathered from a large body of testing acquired over more than a decade, from extensive and ongoing fire testing at Hilti’s test labs in the US and abroad, and by similar testing by the listing laboratories. Hilti has its own horizontal and vertical fire test furnaces for testing in accordance with ASTM E814 (UL 1479) as well as ASTM E1966 (UL2079), and has conducted well over a thousand tests since those furnaces were commissioned. In trying to develop innovative and economical firestop systems, many variables are tweaked and the results tested. Not surprisingly, sometimes many failures are recorded before conditions are sufficiently adjusted to develop the optimized system for a particular fire test. Being able to learn from all of these failed tests provides much of the basis behind the assumptions that certain conditions would result in failure of a fire test, and hence that their performance in a real fire may be less than desired. Of course, this could open up the age-old debate regarding how realistic fire tests are in replicating any specific real-life fire conditions. But as that broader debate is not the subject of this paper, it will be assumed here that if a given condition results in a fire test failure, real-life performance would similarly be compromised, and undesirable.

The 12 deficiencies

General:

- **Installation conducted without referencing a tested system or Engineering Judgment (the "RED IS RIGHT" mentality**)—

Firestopping products carry no inherent fire-resistance ratings. Simply buying a firestop product and installing it in an opening with no point of reference: 1) is unreliable because it may not have been tested in that manner, and, therefore, may not perform its intended function; 2) generates additional risk from a liability point of view; and 3) if it does not comply with a tested system, does not meet the requirements of any of the model building codes in the United States.

A fire-resistance rating is achieved when a **system** is tested by a 3rd party testing organization (e.g. UL, Omega Point, FM, Intertek) and is found to pass the standardized fire exposure test and hose stream test. ASTM E814 and UL 1479, both titled "Fire Tests of Through-Penetration Fire Stops", are the relevant standards which are referenced in the building codes as establishing the requirements for rating of firestop systems. The aforementioned **system** includes, for penetrations: 1) the rated wall or floor assembly, 2) the penetrating item(s), and 3) the firestop materials designed to maintain the integrity of the wall or floor. A **system** for fire-resistance rated construction joints includes the two adjacent rated wall/floor assemblies and the firestopping materials designed to create a commensurate fire-rating of the joint.

Because the majority of firestop sealants are red in color, many people have developed a mental association between "red product" and "firestop". The "red is right" mentality refers to the criteria used by some tradesmen, contractors and even inspectors, that as long as there is some kind of red sealant in the opening or joint, then firestopping is assumed to have been accomplished. The widespread use of this erroneous criteria has even led to legendary cases where people have been known use red dye to color inappropriate sealant materials (e.g. joint compound), knowing that as long as there is red sealant in the openings, no further inquiries are likely to be made. Obviously, this type of activity creates an increased risk of premature fire and smoke spread in the event of a fire, an accompanying increase in liability exposure, and could result in a host of other problems for those attempting to intentionally circumvent the building code. But while everyone would agree this type of activity is "penny wise and pound foolish", that it occurs merely highlights the lack of understanding in the industry of the role of proper firestopping.

- **Jobsite conditions that do not meet the requirements of any listed system – the need for an Engineering Judgment**

Although there are hundreds of tested and listed firestop systems, numerous situations are inevitably encountered which do not *exactly* meet the stated range of conditions of a tested system. The word *exactly* is purposely used here with emphasis, because any condition that deviates in the least from the tested and listed systems needs to be evaluated by someone with appropriate qualifications, to determine if the fire resistance might be negatively impacted by the deviation. The resulting evaluation is typically presented in the form of an Engineering Judgment – a system which is not listed, but which is expected to pass if tested. Because, by definition, it is a "judgment", the qualifications, experience, and reputation of the entity issuing an Engineering Judgment are critical.

The International Firestop Council (IFC) has formulated guidelines for the evaluation of Engineering Judgments. Because these are "guidelines", issuers of Engineering Judgments are not forced to adhere to them. However, encouraging recipients of Engineering Judgments to scrutinize those judgments by teaching them what to look for provides a check-and-balance on an otherwise unregulated practice. Caveat Emptor (buyer beware) have been watchwords for as long as people have sold goods and services to other people. The document, titled "Guidelines for Evaluating Engineering Judgments" can be obtained free of charge from the IFC's website at www.firestop.org.

Guidelines are being developed by an ASTM E05.11 task group to help those who are charged with developing EJs. No other standard or guideline is currently available within the US that specifically addresses the extension-of-data issues that engineers need to consider when developing EJs.

According to the IFC guidelines, EJs should be developed by one of the following:

- the firestop manufacturer's qualified technical personnel
- a knowledgeable registered Professional Engineer, in concert with the manufacturer
- a Fire Protection Engineer
- an independent testing agency that provides listing services for firestop systems

While there will be a desire to provide an EJ for every situation, the truth of the matter is that many situations cannot be handled with an engineering judgment, and the request for an EJ needs to be denied, with no legitimate firestopping solution available. Firestop products are not a cure-all for patching every hole in a fire resistance-rated wall. Whether an indication of the ethical conduct of manufacturers, or fear of liability, the history of the firestopping industry has shown that most tend to issue engineering judgments that are reasonable, supportable and sound. Anyone who has doubts about the validity of a specific EJ, or with firestop EJs in general, is certainly encouraged to evaluate the EJ(s) themselves or through a knowledgeable third party, using the IFC guidelines or other appropriate reference. The IFC guidelines indicate the documentation that should accompany an EJ, which will help provide a basis to make a proper and thorough evaluation of the EJ.

It should be remembered that, all things being equal, firestop systems installed according to Engineering Judgments should only be used when a tested and listed system is not available for the specific application. Using a solution that has been tested provides an inherently higher assurance of performance as compared to a solution which has been developed using engineering analysis, and so should be considered as preferable when available.

Through-Penetrations:

- **Incorrect Annular space**

Annular space is defined as the distance between a penetrant and the nearest inside edge of the opening. Unless a round through-penetrant is placed in the center of a round opening (or, less common, a square through-penetrant centered in a square opening), the annular space around the penetrant will vary, resulting in a maximum and minimum annular space for each particular installation. Tested systems for penetrations generally include limits on the minimum and maximum annular space permitted. In actual practice, these limits are sometimes exceeded.

If there is too little space (i.e., the gap is less than the minimum annular space identified in the listing), there may be insufficient firestop material to perform its intended duty, such as swelling up (“intumescing”) to fill the gap left behind by a plastic pipe or plastic cable jacketing that has melted or burned away in the fire. If the annular space is too large, the firestop material may not have the structural integrity to remain in place during the anticipated design fire exposure.

Minimum annular space limitations are typically established during fire testing when the system is no longer able to restrict the passage of fire. On the other hand, excessive annular gaps are usually identified during the severe test regiment set forth in ASTM E814 or UL 1479, both of which require a hose stream application after fire exposure. The blast from the hose stream usually provides the tough pass/fail condition that determines how much annular space is too much space. With an annular space that is too large, not only might the firestop not perform as expected during a fire, but the excessive span could also result in damage to the integrity of the system from movement and loads that can be experienced in the everyday life of a building. Keeping within the annular space requirements of the listing helps to ensure that the installed firestop has good mechanical strength and is necessary to comply with the listing.

- **Insufficient depth of fill material**

Tested systems typically call for a minimum depth of a particular product, which is the depth that passed the test. Installing less than the specified minimum depth may cause the system to fail prematurely or perform inadequately. The potential failure mechanism will depend on the chemical or physical process by which the firestop material performs its function. For example, if the material is intumescent, there may be insufficient pressure or expanded volume to fill a gap developed by a burned-away penetrant. If the material is ablative (i.e. slowly burns away during the fire exposure), a layer that is not thick enough might be breached before the end of the required fire duration, or may not withstand fire conditions at all. If the material is insulating, the temperature on the unexposed side of the firestop could have a temperature higher than intended, thus propagating fire via ignition of combustibles on the non-fire side. Even in cases where the firestop material merely acts as a seal to prevent the passage of smoke and hot gases (in which case one might think that material thickness is not important), the decrease of thickness will provide less firestop contact area with the substrate (wall or floor). This reduction in bonding may result in the firestop being more prone to being dislodged either during the fire or during the normal lifetime of the penetration. This latter property, “solidity” as one might call it, is severely tested by the hose stream test that is part of ASTM E814 and UL1479.

- **“Percent fill” of cable penetrations exceeded**

Tested systems for cable bundle and cable tray penetrations carry a “percentage fill” as a limiting factor. The percent fill, or “aggregate cross-sectional area of cables” as it is referred to in the UL Fire Resistance Directory, basically defines how much of the hole in the wall or floor is occupied by cables, and what percentage is space available for filling with firestopping material(s). If the calculated percent fill of an opening falls outside the maximum (and sometimes minimum) allowance in the tested system, it may not perform as intended. The percent fill limitation is important to the performance of the firestop system for similar reasons to the annular space limitations discussed above.

One common reason for the percent fill limitation being exceeded is the lack of understanding in calculating it. To calculate it correctly, one has to know the diameter(s) of each cable, calculate and add up the cross sectional areas of those cables, and then divide the sum of the cable cross sections by the size of the opening. NFPA 70, The National Electrical Code, has tables with the areas of various gauges of wire already calculated. The difficulty is in ascertaining the size and number of the various cables in the tray. This is more than many individuals are willing to do.

Because the percent-fill calculation is one of the more frequent installation errors encountered, it may help compliance if listings would also provide percent fill numbers based on the exterior dimensions of the cable bundle or height of the cable layer in a tray. While the variations associated with different combinations of cables makes these visual methods less accurate, they may nevertheless be justified by the increased fire safety associated with easier and more frequent compliance. However, until such a system is developed, calculation of the percent fill will remain as an important and necessary step.

Construction joints:

- **Head-of-Wall joints addressed with tape, joint compound or other materials not part of a Listed system for the application**

Head-of-wall joints are usually dynamic joints. In other words, over time there will be movement at that joint. Except when constructed of very thick concrete slabs, which would barely register any deflection under load, most floors and roofs can experience a measurable deflection under the weight of permanent or transient loads. For example, the International Building Code allows a calculated deflection of up to L/360 for floor members, and a deflection of up to L/180 for roofs that do not support a ceiling, where L is the span between support points (e.g. columns). For a 30 ft span, which is typical, this would therefore be 1 inch of deflection for a floor, and 2 inches for the roof. As a practical matter, most designers of heavily compartmented interior spaces aim for a maximum deflection at mid-span of ½ inch, or L/480, whichever is less, which would be well within the code-allowed maximums. However, in an industrial building, or in large assembly occupancy buildings with no ceilings, the construction could lead to roof deflection in the 3 inch range and still meet code. It should be quite obvious that, in these types of dynamic conditions, a rigid or friable product, such as joint compound, would have difficulty maintaining a seal throughout the life of the building.

The UL 2079 (ASTM E1966) test standard requires dynamic joints to be cycled (extended—compressed—neutral) up to 500 times prior to the fire test and then fire-tested in the fully extended position. Firestop products tested and listed for use in dynamic construction joints have product characteristics that allow for this type of movement, typically by staying flexible when cured.

Given that floor or roof spans will deflect by some amount under load, as there is no such thing as a perfectly rigid material, it would seem prudent that, without some engineering analysis documenting a fit between the "static" movement and the materials to be used to firestop, all top-of-wall joints should be presumed to be dynamic. The (mistaken?) belief in truly static top-of-wall joints, and the associated belief that joint compound or other common construction materials could therefore be adequate to seal this joint, possibly arises from the fact that the listing laboratories do publish static top-of-wall joint systems in their fire-resistance directories. The availability of such systems can lead to misapplication if the installer is not familiar with all the issues.

Besides live loads from building contents and dead loads, floor or roof deflection can also be caused by other normally expected phenomena, such as heating or cooling, accumulation of snow or rainfall, and wind pressures.

In seismic areas, it is critical that fire resistant rated joints remain intact after an earthquake, as that is a period of higher probability of fire. While the UL 2079 (ASTM E1966) cycling test for dynamic joints cannot fully represent all of the multitude of stresses and strains that may be experienced by a joint in every earthquake scenario, using a fire resistive joint system that is tested and listed as a dynamic (rather than static) joint is clearly going to improve its chances of remaining intact when strained. Such systems almost invariably use elastomeric sealants and compressed flexible insulation, which are capable of being expanded or compressed without being crumbled, crushed or dislodged. The same is not necessarily true for the typically rigid products used to seal fire resistive joint systems that are tested and listed for static applications.

Notwithstanding all of the above arguments, it is up to the registered professional who is sealing (certifying) the design documents to decide if a joint is to be installed as a static or dynamic joint. The above is simply intended to provide some understanding of the types of conditions, some of which may not be apparent to everyone, of which types of joints are likely to be dynamic.

- **Improper mineral wool installation**

Fire-resistant joint systems commonly use mineral wool stuffed within the joint, which is then sealed against the passage of smoke and hot gases at one or both faces of the wall or floor with an elastomeric material. The fire tests are conducted with a specific density of mineral wool, typically in the range of 4-8 pounds per cubic foot, but most often at the high end of that range, due to the superior thermal properties of the higher density material. The higher density material is admittedly more difficult to work with, as it is compressed, cut or shaped less easily. Also, lower density mineral wool (i.e. 4 pounds per cubic foot) is more commonly used on construction sites for other purposes. The result is that lower density mineral wool is sometimes improperly substituted for greater density wool (i.e. 8 pcf) in cases where the tested system requires the greater density wool. Using the wrong (lower) density wool can cause the firestop system to fail far short of the desired fire duration, thus creating a significant weak point in the floor or wall. This reinforces the concept that the firestop system must be installed exactly according to its listings to help ensure proper performance. Absent any specification for a component, such as mineral wool or mineral fiber, any material of that genre will typically comply.

A second issue associated with mineral wool usage in firestop systems, as sometimes observed during field verifications, is that the compression of the wool specified in the listed system's installation instructions is sometimes not achieved. The compression ratio might be calculated incorrectly by the installer, or sometimes even ignored. For instance, a 1-1/2" joint that requires mineral wool as a backing material installed with 33% compression would require 2-1/4" of mineral wool compressed into the 1-1/2" gap. (100% - 33% = 67%. 1.5" /.67 = 2.24" mineral wool). This calculation is not an easy one for everyone to do. As a result, it is not uncommon to simply compress the wool somewhat, giving it a slight friction fit into the joint, and assume it is "close enough".

Insufficiently compressed mineral wool provides less resistance to heat conduction, thus leading to the same undesirable result as having a mineral wool with too low of a density (discussed above). The fact that this is somewhat counter-intuitive to many people's expectations of how insulation behaves may be what causes some installers to pay insufficient attention to this detail. More importantly, without sufficient compression, a gap may develop when the joint expands, impairing the integrity of the joint firestop system.

Once again, as with cable percent fill, this may be an opportunity for presentation of the data in another manner that may be easier to understand by some installers. For example, for the case of 33% compression, the bottom line is that the uncompressed piece of insulation must be 50% thicker than the joint it will be inserted into. If the installer were provided with these types of alternative instruction (e.g. “use 1½ inches of insulation width for each 1 inch of joint width and compress the insulation into the joint”), it is possible compliance might increase.

- **Bond breaker tape**

During and after any movement, the firestop joint system needs to stay in contact with the two surfaces it spans to prevent a gap from forming (which could allow the passage of fire, smoke or hot gases). However, the joint system must be free to move vis-à-vis other surfaces. As a result, some Top of Wall firestop systems require bond breaker tape to be installed on the metal top track of a gypsum wall to prevent 3-sided adhesion. In part due to the time and trouble of installing bond breaker tape, this requirement is sometimes found to be overlooked. Without the required bond breaker, the performance of the firestop system may deteriorate to that of a static joint system, since movement could eventually ruin the integrity of the seal.

- **Stud Widths**

Tested systems utilizing gypsum walls typically call out specific stud widths. Systems tested and listed with minimum 3-1/2” studs are not approved, and should not generally be used, in walls with 2-1/2” studs. Fire testing has clearly shown that the smaller stud widths create a more challenging condition for each of the components, including the firestops. Using a firestop system for walls built with studs smaller than those specified in the listing will likely lead to premature breach by a fire. The installer must pay attention to what specific stud sizes a firestop system has been tested and listed for, and select an appropriate system for the conditions encountered on the job site.

- **Head-of-wall joint compression (deflection) and extension beyond the capability of a “stuffed and sealed” joint**

The deflection of roofs and floors was discussed earlier. Installers of fire-resistance rated joint systems are typically in the habit of installing head-of-wall joint systems that use an elastomeric spray or caulk over a mineral wool stuffing. There are many tested and listed systems designed this way. Due to familiarity with these systems some installers will tend to install this type of system without verifying project design documents to ensure that this would be an appropriate method.

The pre-compression of the mineral wool and the polymeric qualities of the sealant give these joint systems their compression and extension capability. However, the movement capability of these systems is limited. The joint can only be compressed to the extent that the mineral wool will not lose its ability to rebound to the maximum extended state identified in the listing. The joint can only be extended so much before the mineral wool is completely decompressed and leaves a gap, or the sealant tears or detaches from the substrate. The maximum amount of movement in compression or extension for the joint systems is specified in the listings as a percentage of the joint size. Movement capabilities of up to 50% are available for some stuffed-and-sealed joint systems. However, movement capability of most joint systems is in the 10-25% range.

Using a 1 inch installed width head-of-wall joint as an example, a 50% movement capability in compression or extension would amount to 1/2 inch of allowable compression (deflection) or extension for the roof or floor above, whereas 10-25% maximum joint movement would amount to only 1/10 to 1/4 inch of allowable floor/roof deflection or extension, respectively. As discussed earlier, typical design constraints and code requirements can allow for up to 1-2 inches of deflection, and even up to 3 inches under some foreseeable circumstances. Fortunately, most floors and roofs will be designed to deflect considerably less than the maximum allowable. However, the fact they are allowed to deflect that much means there may be cases when the stuffed-and-sealed joint systems will not provide adequate movement capability. In the field, an installed joint system with inadequate movement capability can be identified by observing gaps, cracks, crumbling, bulges, tears or other signs of joint material dislodging or being damaged. Cracks in walls are also another common indication of inadequate joint design.

Fortunately, there exist tested and listed mechanical joint systems to handle high movement conditions. These systems allow almost unlimited movement capability. They provide a rated joint seal via engineered track systems that allow the up-and-down movement of overlapping pieces of fire-resistance rated gypsum board, so that no gap ever opens up in the wall due to the defection or extension of the floor or roof above.

It is important that the installer providing the head-of-wall fire resistive joint system be fully aware of the maximum anticipated roof or floor deflection specified in the design documents, so as to realize when the usual practice of installing stuff-and-seal joints needs to be replaced with a mechanical fire resistive joint system.

Perimeter "edge-of-slab" joints:

- **Curtain wall construction does not match tested system construction requirements**

Listed firestop system requirements must be followed to ensure an installation that exactly replicates the tested system. For instance:

Transom height
Transoms (horizontal framing members) must meet the minimum height requirements listed in the firestop system, as measured from the floor up to the bottom of the vision glass. Often, the transom above the floor is closer than the tested system will allow. Note that firestop manufacturers generally understand the value of providing systems with transoms as low as possible, but it has thus far been impossible to pass a system with floor-to-ceiling vision glass (i.e. zero transom height), which is what some architects are specifying.

Typical test failure modes associated with low transom heights have been ignition of the sealant at the top of the perimeter gap. The very low transom heights result in high temperatures, sufficient to cause the ignition. It other words, transoms lower than what is listed in the system requirements can result in premature fire spread, creating a broken link in the fire safety of the building. The fact that the transom height might have been specified below the firestopping requirements because of aesthetic purposes does not typically provide an exemption from the building code requirements that fire passage be prevented at the building perimeter. This conflict needs to be resolved between the design professionals prior to construction of the curtain wall.

Curtain wall insulation joints
Many systems require there be no vertical joints in the curtain wall spandrel insulation between mullions (vertical framing members). In this case the mineral wool insulation sheet must be continuous from mullion to mullion. Unless properly secured against movement during a fire, these vertical seams could potentially open up and provide the path for fire or smoke movement to the floor above, thus defeating the purpose of the perimeter joint firestopping.

Reinforcing steel
Many systems that use panels other than stone or concrete require 20-22ga steel angles to be installed inside the spandrel panel, at the top, bottom and sides. This provides strength and stability to the curtain wall panel as the aluminum mullions and transoms begin to soften and deflect under fire conditions. If steel angles are a listed requirement in the firestop system, they must be installed in the curtain wall. In those situations where fire protection is an afterthought, the firestop contractor is expected to come in after construction and "make it safe". However, when certain components need to be added to the wall construction itself, as in this case, it may be impossible to come in after the fact and provide a perimeter fire barrier system that would equal the rating of the floor slab. Without coordinated action during the specification and construction of the curtain wall, it can become impossible (or expensive) to later provide the code-mandated protection at the perimeter barrier.

Impaling pins and Z-clips
As with reinforcing steel, this is something that needs to be coordinated during curtain wall erection, and sometimes is not. To ensure the success of the

perimeter firestop system, it is imperative that the insulation filling the gap wall and preventing heat transfer must stay in place. This is typically accomplished with welded or screwed pins or clips that go through the insulation and which are attached to the spandrel panels.

The mineral wool insulation which is used to fill the gap between the curtain wall and the floor slab, often referred to as “safing”, may also require some type of mechanical attachment. Some listed perimeter fire barrier systems require Z-clips to hold the safing in place. Unfortunately, this is sometimes omitted by installers, possibly due to an incorrect judgment that the friction fit of the compressed safing provides sufficient securement, or who might be in the habit of installing listed systems that do not require that securement. Although it might seem secure on the day of the installation, the stresses and deformation of the wall panels during fire exposure may render the friction fit insufficient to hold the safing in place. Only fire testing can determine whether a particular perimeter fire barrier system will require the Z-clips. The lack of trustworthy securement of safing in the past is the reason that the model codes all have a specific requirement for the material to be “securely installed”. Fallout of perimeter gap insulation was identified as a major fire spread factor in the multi-story high-rise fire at the First Interstate Bank Building (Los Angeles) in 1988.

- **Improper mineral wool installation**

Mineral wool oftentimes is incorrectly installed with fibers running horizontally (perpendicular to the curtain wall studs), instead of vertically (parallel to the curtain wall studs). Mineral wool cannot be properly compressed along the axis of its fibers. It can only be compressed by pushing the parallel length of fibers closer together. Improper compression of mineral wool can dramatically shorten the fire resistance of a joint firestop system, as discussed earlier.

- **Curtain wall installations referencing traditional joint systems**

Perimeter Fire Barrier Systems are tested under a unique set of criteria, substantially different from traditional Top of Wall or Floor to Wall type systems. One key difference is that unlike perimeter systems, Top of Wall and Floor to Wall systems are tested using two fire-rated assemblies that meet at a ninety degree angle. A perimeter fire barrier system, on the other hand, is tested using a fire-resistive **rated** floor and a **non-rated** curtain wall.

Another key difference is that the curtain wall perimeter barrier system is tested with a fire exposure from two sides. This two-sided fire exposure is meant to replicate one set of conditions that would feasibly be experienced in a true-life fire, where the fire exposes the joint from the floor below and also from the outside of the building, due to flame extension out of the window on the floor below. Top of Wall and Floor to Wall joint systems do not attempt to test for such multi-directional fire exposure, and therefore such testing may not provide information relevant to the proper construction of perimeter fire barrier systems.

As initially noted, this is but a sampling of mistakes that can be made during all phases of firestopping. Thankfully, with education and awareness, these errors can be detected and prevented. Many firestop manufacturers provide free, on-site firestopping workshops to assist construction professionals in selecting and installing proper firestopping systems.

As a final safeguard against errors in firestop installation, a knowledgeable and thorough inspection can help identify mistakes, providing the opportunity to make corrections before interior finishing activity makes it less practical. ASTM has issued Standard Practice E2174, which provides a systematic through-penetration firestop inspection methodology. An analogous document will likely be issued by ASTM in early 2005 for the inspection of fire-resistive joint systems. A pocket guide to firestop inspection is also available from the International Firestop Council, which helps to identify the error-prone details in the firestopping of through-penetrations, joints, and the curtain wall perimeter gap.

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