

An Overview of Firestopping and Fireblocking: What's the Difference?

By
Vickie J. Lovell
Building Code Consultant
InterCode, Incorporated

Revised June 26, 2001

Attention was drawn to the problem of unprotected or improperly protected penetrations through floors and walls and also fire migration within walls and floor assemblies during the 1960's and 1970's. Several tragic building fires with multiple fatalities highlighted the need to protect openings around penetrations and to limit the migration of fire and smoke within concealed spaces. During the late 1970's, building code development in the United States, Canada, Australia, and Germany began reflecting interest in resisting or stopping fire migration by requiring generic, usually noncombustible, materials to be installed in these locations. All methods and materials were referred to as firestops at that time. Until recently, most of the United States used the term "firestopping" interchangeably when describing two different construction features:

- 1) Barriers consisting of generic construction materials installed in combustible construction to resist or block, for an undetermined period of time, the spread of fire within the cavities, referred to as the "concealed spaces" of walls, floors, stairs and attics.

- 2) Factory-built devices or field-assembled materials installed in the openings around plumbing pipe, electrical conduit, cable trays and similar items which pass through fire resistance rated assemblies from one compartment to another. Such assemblages of materials are capable of maintaining the fire rating of the assemblies penetrated for a prescribed period of time.

Until the 1990's, there has been little guidance in the building codes on how to install the materials effectively in order to accomplish either of the two different objectives. This oversimplified approach to a specific fire protection objective has raised a number of questions in its practical application.

In order to address these issues, it is important to understand how the existing code terminology developed and the prevailing interpretations of "firestopping", "fireblocking" and "draftstopping".

ORIGINS OF THE TERM “FIRESTOPPING”–

The practice of protecting penetrations that pass through the fire-rated assembly from one compartment to another was, and still is, referred to in the construction industry as “firestopping”. During the late 1970’s, the American Society for Testing and Materials, the National Research Council of Canada, Portland Cement Association, U.S. Gypsum, Underwriters Laboratories (US and Canada), Society for the Plastics Industry of Canada, the Nuclear Regulatory Commission and others began testing a variety of materials used for all types of firestopping. It became apparent from laboratory testing that the typical generic noncombustible firestopping materials, such as mortar or fibrous materials, used to protect combustible penetrations, i.e. plastic pipes, cables with PVC jacketing, electrical non-metallic conduit and similar penetrations would not provide adequate fire resistance in walls and floors. Early test reports also indicated that noncombustible penetrations through floors and walls firestopped with generic noncombustible materials did not perform satisfactorily and consistently unless the materials were carefully installed in accordance with specific installation depths and dimensions based on the fire rating, and compatibility with the construction of the assembly penetrated.

Even though laboratory testing indicates that the way some generic materials are often installed in the field will not consistently and satisfactorily perform in an actual fire, many areas of the United States have historically permitted a wide range of products for firestopping typically found on a construction site: wood, mineral or glass fiber insulation, brick, sheet metal, gypsum board, concrete, mortar, plaster, even sand, without much consideration for how or where it was installed.

DEVELOPMENTS IN PROTECTING THROUGH-PENETRATIONS

In 1975, a dangerous, and potentially disastrous fire at the Browns Ferry Nuclear Power Plant, which spread through cable trays, heightened the need for specific materials to protect penetrations. By 1983, ASTM E-814, the “Test Method for Fire Tests of Through-Penetration Fire Stops” was completed. This standard established a performance criteria for materials used to protect through-penetrations which pass through fire resistance rated assemblies. The test specimens are subjected to a severe fire exposure under positive pressure, and are evaluated using three separate rating identifiers, the F, T and L ratings, coupled with hose stream tests. It provides an excellent indication as to the firestop assembly’s capabilities regarding fire, hot gases, temperature rise, and air (smoke) leakage. Eventually, ASTM E-814 was adopted by all the model building codes in the United States, including other countries. The NFPA Life Safety Code, the NFPA National Electric Code and most recently, the IAPMO 2002 Uniform Plumbing Code have all adopted ASTM E-814 as a performance standard for protecting through penetrations.

DEVELOPMENTS IN FIREBLOCKING AND DRAFTSTOPPING –

The American Forest and Paper Association (AFPA, formerly the National Forest Products Association (NfoPA), has addressed possible fire spread within the cavities, or concealed draft openings in wood frame construction. Wood structural members can shrink as the wood

seasons to 19% moisture content. AFPA has recommended subdividing the large concealed spaces (by draftstopping with materials such as wood sections or gypsum board), and by subdividing the small spaces inside the stud walls, at soffits and drop ceilings and at the top and bottom of stair stringers, etc. (fireblocking). The intent is to contain a fire within the wall cavity to a small area, and to impede the fire from freely migrating to other connecting, concealed spaces.

Confusion about how to protect pipes and similar penetrations as they passed through fire rated assemblies, and as they passed through fireblocks and draftstops within concealed spaces of wall and floor assemblies have existed due vague code language and to the misuse of the term “firestop” to describe different construction practices. Firestopping and fireblocking, as well as, fireblocking and draftstopping, are still essentially the same in some people’s minds. But they are clearly different. Fortunately, changes were made in the codes to help clarify the intent and meaning and to distinguish one practice from another.

NEW TERMINOLOGY -

From the mid 1980’s on, protecting through-penetrations (firestopping) had evolved into a performance- oriented discipline, which was reflected in the building codes. The building codes also began to more clearly distinguish the requirements for subdividing large concealed spaces (draftstopping) and small concealed spaces (fireblocking) within wood frame construction. By 1996, all three model codes groups approved changes to revise their codes to clearly distinguish “firestopping” from “fireblocking” (1997 UBC, 1976 SBC, 1996 NBC).

Today, a “Through-Penetration Firestop System” is described in the three model codes (including the 2000 International Building Code) as either a through penetration or a membrane penetration consisting of a tested method and materials used to protect penetrations, pipes, tubes, wire, cables, cable trays, and similar items which pass through fire resistance rated construction, and to stop fire and hot gases for a prescribed period of time.

“Fireblocking”, is now defined as generic materials, such as lumber, structural wood panels, gypsum board, cement fiberboard, or particleboard, batts or blankets of glass or mineral wool installed within concealed spaces to resist, or block, the migration of fire and hot gases for an undetermined period of time. Fireblocking is used to subdivide or block off the stud cavity inside a wall, in a soffit over cabinets, between stair stringers at the top and bottom of a run, in an exterior cornice, in the space between the combustible finish materials and the wall itself.

The definitions of “Draftstopping” are similar to fireblocking. Draftstopping is used to subdivide flooring at specific intervals and in attics and crawl spaces. In combustible construction, nearly all the codes specify that lumber or wood structural panels may be used for this purpose. Some codes include other draftstopping materials such as gypsum board, cement fiberboard, or particleboard.

A simple change in the terminology to more clearly define firestopping and the new term fireblocking (and draftstopping) have begun to clear up misunderstandings as to the intent of the code requirements in the more recent editions of the building codes. Unfortunately, there is still difficulty in interpreting the intent of older editions of the codes where the term “firestop” is used

interchangeably with the requirements for fireblocking and draftstopping, or where the requirements for the protection of penetrations are not carefully spelled out.

Recently, loose-fill insulation material was introduced in the 2000 International Building Code as a fireblock material if specifically tested in the form and manner intended for use and can be shown to remain in place and to retard the spread of fire and hot gases. As was mentioned previously, there is no specific performance test for fireblocks. So, the acceptance of loose-fill insulation as a fireblock as permitted by the code may be subject to a review of the available test data from groups having conducted their own investigations such as the Cellulose Insulation Manufacturing Association.

THE FINE POINTS: DOES “NONCOMBUSTIBLE” MEAN NONCOMBUSTIBLE?

The codes containing language which addresses fireblocks and draftstops have historically required “noncombustible materials” to be used to protect penetrations such as piping, ducts, flues, or vents that were located **within the wall, ceiling, or attic cavity** as they passed through the members serving as fireblocks or draftstops.

The 1996 National Building Code, the 1997 Uniform Building Code, and the 1997 Standard Building Code all have a subsection pertaining to combustible construction that reads along these lines:

“Fireblocking (*some older code editions still use “firestopping”*) shall consist of approved noncombustible materials securely fastened in place...**at openings around vents, pipes, ducts, chimneys and fireplaces** at ceiling and floor levels...”. (*italics ours*)

These code sections that require the use of noncombustible materials as fireblocks in combustible construction have often puzzled many code-users and enforcers. The origin and the reason for the noncombustible fireblock have not been clearly conveyed in the recent code text. However, the fact that chimneys and fireplaces are specified in these sections should give some clue as to the original intent for this requirement since both of these heat-producing features require “clearance from combustibles”.

Although it has been difficult to document, some sources have suggested that the earliest code sections were originally developed in anticipation of high temperatures associated with the operation of mechanical equipment such as furnaces, fireplaces, and their related vents, chimneys and piping in combustible construction. As a precaution, noncombustible materials were required to be used to protect the combustible framing from close proximity or possible point contact with heat producing appliances. A material that would not quickly ignite or contribute to the fuel load where these heat-producing items penetrate a combustible structural member or a wood fireblock seemed logical.

The noncombustible material was intended to be used to restore the integrity of the fireblock or draftstop where penetrated by piping or vents, etc., and to provide an insulating effect between the piping or vent and the wood framing by protecting the combustible framing member from possible charring or ignition.

The question has recently arisen as to whether the intent of the code was to specify that noncombustible fireblocks, or noncombustible materials used to restore the integrity of combustible fireblocks, are required to be tested to determine their noncombustibility in accordance with ASTM E136 "Test Method for Behavior of Materials in a Vertical Tube Furnace at 750o C", or whether an ordinarily accepted meaning or a definition found in a dictionary for "noncombustible" could be used by the authority having jurisdiction.

Code sections on fireblocking generally do not specify a test method in conjunction with fireblocking, although some more recent code editions contain a general definition of noncombustibility which conforms to ASTM E-136. Code officials have historically been extended the latitude to make their decision based on locally accepted practice, although many have required noncombustible fireblocks to be tested in accordance with ASTM E-136. These AHJs cannot be criticized for using strictest interpretation since that is simply what the code says. But the interpretation of "noncombustible" and the enforcement of these sections have not been consistent from jurisdiction to jurisdiction.

Although no code states this, reason would dictate that in combustible construction it is not logical to require noncombustible fireblocking materials on items that do not transfer heat, such as plastic DWV plumbing pipe that penetrates a wood top plate drilled to provide a tight fit. Where the opening is larger than the pipe, any other material listed and tested for use on through-penetrations, or approved by the authority having jurisdiction could be used as a fireblock material. This approach probably most closely follows the original spirit and intent of the fireblocking requirements. But the code does not state those words at this time. As a result, some jurisdictions are enforcing the letter of the code, which compels them to enforce the use of materials that have been tested to ASTM E-136, a widely used test method to determine noncombustibility. Others have decided to take a broader interpretation and are permitting a variety of products and materials.

On the other hand, there may another situation where the same plastic DWV plumbing pipe penetrates the top plate, exiting a non-fire rated wall assembly but enters a fire rated floor-ceiling area. The code official may determine that this plumbing pipe is required to be protected as a through-penetration and require a tested firestop system, exceeding the requirements for fireblocking. Each situation requires some thoughtful consideration based on the variables.

NEW CODES –

The drafting process of the International Building Code (IBC) and the International Residential Code (IRC) afforded another opportunity to further clarify these construction practices and code requirements. The 2000 IBC requirements on the protection of penetrations are found in a stand-alone Section 711 "Penetrations". Information on fireblocks is found in Section 715 "Concealed Spaces". Definitions for both are located in the beginning of Chapter 7 "Fire Resistance Rated Construction".

The 2000 IBC and IRC (in Section R602.8) both have eliminated the "noncombustible" requirements pertaining to fireblocks and are revised to read "approved material to resist the free passage of flame and the products of combustion". In this solution, the use of noncombustible materials as fireblocks is permitted where appropriate. The authority having jurisdiction may determine that the narrowest interpretation of the word "noncombustible" (as in accordance with ASTM E-136) may not be necessary at every location. After a thorough review

of the history of this subject, these new code sections are more consistent with the original intent and are certainly more concise as to their meaning.

CONCLUSION –

The overall objective is to stop the extension of fire and hot gases through penetrations in walls and floors AND to block the free passage of fire and hot gases within a concealed space. There are a great variety of products and materials that will accomplish that fire safety objective. While there is still some development to determine what is most effective, there is no doubt about what is not effective. That unacceptable option is to leave penetrations and concealed spaces unprotected or insufficiently protected, thereby exposing occupants to the risk of tragic failures we have already experienced from the not too distant past.

Sources:

- G. E. Troxell, Fire Test of a Concrete and Steel Floor Assembly Incorporating Electrical Fittings with Conduit Penetrating the Assembly, Standard Test No. 38 Fire Prevention Research Institute, 1965
- John G. Degenkolb, "Poke Through - a Problem of Basic Fire Protection, 1967
- M.S. Abrams and A.H. Gustafiero, Fire Tests of Poke Through Assemblies, Fire Research Section, Portland Cement Association, 1971.
- M. L. Scott, "Browns Ferry Nuclear Power Plant Fire on March 22, 1975, Nuclear Safety, Vol. 17, Sept-Oct, 1996,
- N. Sawyer and J. Eisner. "Cable Fire at Browns Ferry Nuclear Power Plant, Fire Journal, Vol. 70, No 4. July, 1976.
- US Nuclear Regulatory Commission, Regulatory Guide, 1.120 and 10 Code of Federal Regulations, Part 50.
- Twelve Die in Fire at West Chase Hilton Hotel, Houston, Fire Journal, January, 1983
- A. Sears, Jr. Another Home for Aged Fire: Ten Killed, Fire Journal, May 1971
- J. Lathrop, World Trade Center Fire, New York, New York, Fire Journal, 1975
- H. Olin, Construction Principles, Materials and Methods, 5th edition, 1990
- Council of American Building Officials, CABO One and Two Family Dwelling Code, 1992 and 1995 Editions
- Southern Building Code Congress International, Standard Building Code, 1988 and 1997 Editions
- Building Officials and Code Administrators, National Building Code, 1987 and 1996 Editions
- International Conference of Building Officials, Uniform Building Code, 1988 and 1997 Editions
- International Code Council, International Building Code and the International Residential Code, 2000 Editions.
- American Forest and Paper Association, 1111 19th Street NW, Washington, DC 20036