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Standard Guide for Understanding and Using Information Related to Installation of Firestop Systems[1]

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INTRODUCTION

This guide should[2] increase the awareness of information and approaches associated with installing *firestop systems*. Various building trades (also known as construction trades) create *openings* (breaches or penetrations) in *fire-separating elements* to accommodate the installation of existing or future *penetrating items* such as pipes, ducts, wires, etc. The materials and methods of construction used to seal and protect *openings* created in *fire-separating elements* must not reduce its existing fire-resistance rating. Multiple building trades are sometimes involved with the process of restoring the fire-resistance rating of the *fire-separating element*. Often the building trade (for example, firestop contractor) responsible for restoring the fire-resistance rating of the *fire-separating element* did not create the *opening*. This guide is intended to help identify and alleviate problems as well as misunderstandings associated with the installation of *firestop systems*. This guide is intended to provide information to those that create the *opening*, install the *penetrating item* through the *opening*, install *firestop materials* for the *opening*, and those charged with the inspection of the *firestop system* during and after installation. This guide proposes a series of options or instructions that offer direction without recommending a definite course of action for the installation of *firestop systems*.

1. Scope

1.1 This guide is a compendium of information related to installing *firestop systems* in *fire-separating elements*. This guide is intended to be used to increase industry knowledge of national and international testing requirements, code prerequisites, and other supplemental tests that may be specified, which can affect the installation and performance of *firestop systems*.

1.2 This guide relates to the use of *firestop systems* tested, or evaluated, to Test Method E814 and other test methods addressing the same specific subject matter, such as CAN/ULC-S115; EN 1366-3; IMO Resolution MSC.307(88), FTP Code; IEEE 634; ISO 10295-1; UL 1479; etc.

1.3 This guide also addresses the use of *firestop systems* tested or evaluated to Test Methods E119 or other test methods that use a *firestop system* as a component of a typically larger test assembly, such as AS 1530.4; BS 476-21; BS 476;[3] CAN/ULC-S101; ISO 834;[4] NFPA 251; UL 263; etc.

1.4 This guide discusses the installation of *firestop systems* in *membrane penetrations* and *through penetrations*. The installation is typically performed by a firestop contractor (also known as a firestop installer or an installer). However, the quality of the installation is based on the information provided to the firestop contractor as well as the expertise and competence of the firestop contractor. A lack of information in the test report, *listing*, *manufacturer's instructions*, or project documents can be the cause of a deficient installation.

1.5 The term "*firestop system*" refers to and includes both a *membrane-penetration firestop system* and *through-penetration firestop system*.

1.6 Information in this guide is applicable to *firestop systems* that accommodate single or multiple *penetrating items*.

1.7 This guide does not address the design aspects of locating and defining the dimensions of an *opening*; or the method to create the *opening*; or the inspection of the *penetrating item* prior to *firestop material* installation. However,

[1] This guide is under the jurisdiction of ASTM Committee E06 on Performance of Buildings and is the direct responsibility of Subcommittee E06.21 on Serviceability.

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[2] "Should" is used to indicate that a provision is not mandatory but is recommended as good practice.

[3] In this guide, BS 476–21 and BS 476–22 are collectively referred to as BS 476.

[4] In this guide, ISO 834-1, ISO 834-4, ISO 834-5, ISO 834-6, ISO 834-8, and ISO 834-9 are collectively referred to as ISO 834.

locating and defining the dimensions of an *opening* and the method to create the *opening* are critical to a *firestop system*'s installation.

1.8 This guide does not address all the test methods needed to address proper performance of all *firestop systems* or *firestop materials*.

NOTE 1—For example, IEEE 848 provides information on the ampacity derating of cables that are protected by *firestop systems* using IEEE 835 as baseline information.

1.9 This guide does not address all the test methods needed to address proper performance of *firestop systems* in all installations. For a specific application of a *firestop system* one or more of the following are consulted when available:

1.9.1 The *firestop system*'s test report or *listing*;

1.9.2 The *manufacturer's instructions* when they are not in conflict with the *firestop system*'s test report or *listing*; or

1.9.3 A *judgment* with justifiable technical rationale prepared based on a *firestop system*'s test report or *listing*.

1.10 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.11 *The text of this standard references notes and footnotes which provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of the standard.*

1.12 *This guide offers an organized collection of information or a series of options and does not recommend a specific course of action. This document cannot replace education or experience and should be used in conjunction with professional judgment. Not all aspects of this guide may be applicable in all circumstances. This ASTM standard is not intended to represent or replace the standard of care by which the adequacy of a given professional service must be judged, nor should this document be applied without consideration of a project's many unique aspects. The word "Standard" in the title of this document means only that the document has been approved through the ASTM consensus process.*

1.13 Fire standards, other than ASTM standards, are referenced in this document. The following caveat applies to all fire standards referenced in this guide. *Fire testing is inherently hazardous. Adequate safeguards for personnel and property shall be employed in conducting these tests.*

1.14 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.15 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[5]

C717 Terminology of Building Seals and Sealants

E84 Test Method for Surface Burning Characteristics of Building Materials

E119 Test Methods for Fire Tests of Building Construction and Materials

E136 Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 °C

E176 Terminology of Fire Standards

E631 Terminology of Building Constructions

E814 Test Method for Fire Tests of Penetration Firestop Systems

E1529 Test Methods for Determining Effects of Large Hydrocarbon Pool Fires on Structural Members and Assemblies

E1966 Test Method for Fire-Resistive Joint Systems

E2032 Practice for Extension of Data From Fire Resistance Tests Conducted in Accordance with ASTM E 119

E2174 Practice for On-Site Inspection of Installed Firestop Systems

E2226 Practice for Application of Hose Stream

E2307 Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus

E2393 Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers

E2750 Guide for Extension of Data from Penetration Firestop System Tests Conducted in Accordance with ASTM E814

E2785 Test Method for Exposure of Firestop Materials to Severe Environmental Conditions

E2786 Test Methods for Measuring Expansion of Intumescent Materials Used in Firestop and Joint Systems

E2837 Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies

E2923 Practice for Longevity Assessment of Firestop Materials Using Differential Scanning Calorimetry

E3021/E3021M Guide for Evaluating the Relative Effectiveness of Building Systems to Resist the Passage of Products of Combustion Based on the Aggregation of Leakage Rates

E3037 Test Method for Measuring Relative Movement Capabilities of Through-Penetration Firestop Systems

[5] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

E3038 Practice for Assessing and Qualifying Candidates as Inspectors of Firestop Systems and Fire-Resistive Joint Systems

2.2 *ACI Standard:*[6]

ACI /TMS 216.1 Code Requirements for Determining Fire Resistance of Concrete and Masonry Construction Assemblies

2.3 *Standards Australia:*[7]

AS 1530.4 Methods for fire tests on building materials, components and structures – Part 4: Fire-resistance tests of elements of construction

AS 4072.1 Components for the protection of openings in fire-resistant separating elements – Part 1: Service penetrations and control joints

2.4 *BSI Standards:*[8]

BS 476-20 Fire tests on building materials and structures. Method for determination of the fire resistance of elements of construction (general principles)

BS 476-21 Fire tests on building materials and structures. Methods for determination of the fire resistance of loadbearing elements of construction[3]

BS 476-22 Fire tests on building materials and structures. Method for determination of the fire resistance of non-loadbearing elements of construction[3]

2.5 *SCC Standards:*[9]

CAN/ULC-S101 Standard Methods of Fire Endurance Tests of Building Construction and Materials

CAN/ULC-S102 Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies

CAN/ULC-S115 Standard Method of Fire Tests of Firestop Systems

2.6 *CEN Standards:*[10]

EN 1366-3 Fire resistance tests for service installations – Part 3: Penetration seals

EN 1366-4 Fire resistance tests for service installations – Part 4: Linear joint seals

EN 13501-1 Fire classification of construction products and building elements – Part 1: Classification using data from reaction to fire tests

2.7 *GA Standard:*[11]

GA-225 Repair of Fire-Rated Gypsum Panel Product Systems

2.8 *ICC Standard:*[12]

ICC International Building Code[13](IBC[13]), 2018 Edition

2.9 *IEEE Standards:*[14]

IEEE 634 Standard Cable-Penetration Fire Stop Qualification Test

IEEE 835 Standard Power Cable Ampacity Tables

IEEE 848 Standard Procedure for the Determination of the Ampacity Derating Factor for Fire-Protected Cable Systems

2.10 *IMO Standards:*[15]

IMO Resolution A.753 Guidelines for the Application of Plastic Pipes on Ships

IMO Resolution MSC.307(88) International Code for Application of Fire Test Procedures (FTP Code)

IMO Safety of Life at Sea (SOLAS)

2.11 *ISO Standards:*[16]

ISO 834-1 Fire-resistance tests – Elements of building construction – Part 1: General requirements[4]

ISO 834-4 Fire-resistance tests – Elements of building construction – Part 4: Specific requirements for loadbearing vertical separating elements[4]

ISO 834-5 Fire-resistance tests – Elements of building construction – Part 5: Specific requirements for loadbearing horizontal separating elements[4]

ISO 834-6 Fire-resistance tests – Elements of building construction – Part 6: Specific requirements for beams[4]

ISO 834-8 Fire-resistance tests – Elements of building construction – Part 8: Specific requirements for non-loadbearing vertical separating elements[4]

ISO 834-9 Fire-resistance tests – Elements of building construction – Part 9: Specific requirements for non-loadbearing ceiling elements[4]

ISO 10295-1 Fire tests for building elements and components – Fire testing of service installations – Part 1: Penetration seals

ISO 10295-2 Fire tests for building elements and components – Fire testing of service installations – Part 2: Linear joint (gap) seals

ISO 17065 Conformity assessment – Requirements for bodies certifying products, processes and services

2.12 *NFPA Standards:*[17]

NFPA 70[18] National Electrical Code[18] (NEC[18])

NFPA 90A Standard for the Installation of Air-Conditioning and Ventilating Systems

NFPA 96 Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations

NFPA 251 Standard Methods of Tests of Fire Endurance of Building Construction and Materials

NFPA 255 Standard Method of Test of Surface Burning Characteristics of Building Materials

[6] Available from American Concrete Institute (ACI), 38800 Country Club Dr., Farmington Hills, MI 48331-3439, http://www.concrete.org.

[7] Available from Standards Australia, GPO Box 476, Sydney NSW 2001, Australia, http://www.standards.org.au.

[8] Available from British Standards Institution (BSI), 389 Chiswick High Rd., London W4 4AL, United Kingdom, http://www.bsigroup.com.

[9] Available from Standards Council of Canada (SCC), 55 Metcalfe Street, Suite 600, Ottawa, ON K1P 6L5, Canada, https://www.scc.ca/.

[10] Available from European Committee for Standardization (CEN), CEN-CENELEC Management Centre, Rue de la Science 23, B - 1040, Brussels, Belgium, https://www.cencenelec.eu/.

[11] Available from Gypsum Association, 962 Wayne Ave., Suite 620, Silver Spring, MD 20910, https://www.gypsum.org.

[12] Available from International Code Council (ICC), 500 New Jersey Ave., NW, 6th Floor, Washington, DC 20001, http://www.iccsafe.org.

[13] A registered trademark of International Code Council.

[14] Available from Institute of Electrical and Electronics Engineers, Inc. (IEEE), 445 Hoes Ln., Piscataway, NJ 08854-4141, http://www.ieee.org.

[15] Available from International Maritime Organization (IMO), 4, Albert Embankment, London SE1 7SR, United Kingdom, http://www.imo.org.

[16] Available from International Organization for Standardization (ISO), ISO Central Secretariat, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, https://www.iso.org.

[17] Available from National Fire Protection Association (NFPA), 1 Batterymarch Park, Quincy, MA 02169-7471, http://www.nfpa.org.

[18] A registered trademark of National Fire Protection Association.

2.13 *UL Standards:*[19]

UL 263 Standard for Fire Tests of Building Construction and Materials

UL 723 Standard for Test for Surface Burning Characteristics of Building Materials

UL 1479 Standard for Fire Tests of Penetration Firestops

3. Terminology

3.1 *Definitions*—For definitions of general terms related to fire used in this guide, refer to Terminology E176. For convenience and direct application in this guide, the existing definitions for a number of general concepts related to *firestop systems* are as follows:

3.1.1 *authority having jurisdiction (AHJ), n*—the designated authority, or their duly authorized representative, charged with the administration and enforcement of the local fire code or building code, or both. **E2174**

3.1.2 *authorizing authority (AA), n*—the designated person, or organization, or their duly authorized representative, charged with the administration and enforcement of the provisions of this inspection document. **E2174**

3.1.2.1 *Discussion*—Examples of the AA include the responsible architect, engineer, building owner, or their representative.

3.1.3 *fire-resistive joint system, n*—a device or designed feature that provides a fire separating function along continuous linear *openings*, including changes in direction, between or bounded by *fire-separating elements*. **E1966**

3.1.4 *firestop industry inspector, n*—the individual or company possessing the credentials set forth in Practice E3038, and who is authorized by the AHJ or AA, or both, to conduct an inspection under Practices E2174 and E2393, or both. **E3038**

3.1.5 *firestop system, n*—a specific combination of *penetrating item* or items, the specific construction that is penetrated, and the materials or devices, or both, that seal the *opening* provided to accommodate one or more items that penetrate into or through a fire-resistance rated assembly. **E814**

3.1.5.1 *Discussion*—The materials and devices used to seal the *opening* around *penetrating items* are sometimes referred to as "firestops." Note that it is not "firestops" that are tested by Test Method E814, but rather "*firestop systems*." Due to the complex interaction during a fire between the penetrant, the penetrated assembly, the materials, or devices, or combinations thereof, used to seal the penetration, and the specific size and shape of the *opening*, it is not possible to simply test the "firestop" to develop fire resistance data.

3.1.5.2 *Discussion*—The term *firestop system* refers to and includes both a *membrane-penetration firestop system* and a *through-penetration firestop system*. (See also *firestop device*, *fill material*, *firestop material*, *firestop sealant*, and *forming material*.)

3.1.6 *judgment, n*—an evaluation of a field condition which does not conform to an existing tested and listed system. **E2174**

3.1.6.1 *Discussion*—There are documents that assist in producing sound *judgments* with justifiable technical rationale. For example, Guide E2750 provides information to extend the results from fire tests conducted in accordance with Test Method E814. Guide E2750 limits the extension of data to a single aspect because when more than one aspect is assessed, the technical rationale becomes much more complicated. *Judgment* is also defined in Practice E2393.

3.1.7 *membrane-penetration firestop system, n*—a *firestop system* that seals the *opening* provided to accommodate one or more items that penetrate the membrane on only one side of a fire-resistance rated assembly. **E814**

3.1.7.1 *Discussion*—Examples of *penetrating items* include cables, conduits, ducts, pipes, and electrical boxes.

3.1.7.2 *Discussion*—In the ICC International Building Code,[13] a "*membrane-penetration firestop system*" is defined as "an assemblage consisting of a fire-resistance rated floor-ceiling, roof-ceiling, or wall assembly, one or more *penetrating items* installed into or passing through the breach in one side of the assembly and the materials or devices, or both, installed to resist the spread of fire into the assembly for a prescribed period of time."

3.1.8 *through-penetration firestop system, n*—a *firestop system* that seals the *opening* around *penetrating items* that pass through the entire fire-resistance rated assembly. **E814**

3.1.8.1 *Discussion*—Examples of *penetrating items* include cables, cable trays, conduits, ducts, and pipes.

3.1.8.2 *Discussion*—In the ICC International Building Code,[13] a "*through-penetration firestop system*" is defined as "an assemblage consisting of a fire resistance-rated floor, floor-ceiling, or wall assembly, one or more *penetrating items* passing through the breaches in both sides of the assembly and the materials or devices, or both, installed to resist the spread of fire through the assembly for a prescribed period of time."

3.1.9 For definitions of general terms related to building construction used in this guide, refer to Terminology E631.

3.1.10 For definitions of general terms related to building seals and sealants used in this guide, refer to Terminology C717.

3.1.11 When there is a conflict between terms in Terminology E631 and Terminology C717, the terms in Terminology E631 prevail.

3.1.12 When there is a conflict between terms in Terminology E176 and Terminology E631 or Terminology C717, the terms in Terminology E176 prevail.

3.1.13 Terms specifically defined in 3.1 and 3.2, whenever used as intended for this document, are italicized for ease of identification and reference.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *Discussion*—A number of concepts are discussed in this guide to help establish a link with the terminology used within some building codes and other national and international test standards. This includes, but is not limited to, *annular space*, *fire barrier*, *fire-separating element*, *horizontal assembly*, *membrane penetration*, *membrane-penetration firestop system*, *through penetration*, and *through-penetration firestop system*.

[19] Available from Underwriters Laboratories (UL), 14301 SE 1st Street, Suite 140, Vancouver, WA 98684, http://www.ul.com.

3.2.2 *annular space, n*—the void around the *penetrating item* within an *opening*.

3.2.2.1 *Discussion*—*Annular space* is defined in the ICC International Building Code[13] as "the *opening* around the *penetrating item*."

3.2.3 *cable fill ratio, n*—the amount of cross-sectional area of a cable sleeve device that is occupied by a cable(s).

3.2.3.1 *Discussion*—The calculation of the *cable fill ratio* is based on the outside diameter of the cable(s) and the cable sleeve device's inside diameter.

3.2.4 *fill material, n*—a certified *firestop material* that is placed in an *annular space* to fill all or part of the *annular space*.

3.2.4.1 *Discussion*—Certified products usually have a *listing* label applied to them as "identification applied to the product that includes the name of a quality assurance agency indicating that a representative sample of the product or material has been tested and evaluated by the quality assurance agency," which is the definition in Practice E2174 and Practice E2393.

3.2.5 *fire barrier, n*—an interior wall or partition that has a fire-resistance rating determined in accordance with Test Methods E119 or a standardized test method with similar intent.

3.2.5.1 *Discussion—Fire barrier* is defined in the ICC International Building Code[13] as "a fire-resistance-rated wall assembly of materials designed to restrict the spread of fire in which continuity is maintained." Sometimes other industry terms are used in lieu of fire-resistance-rated wall assembly, such as fire walls, fire partitions, smoke barriers, demising wall, etc.

3.2.6 *fire-separating element, n*—either a *fire barrier* or a *horizontal assembly*.

3.2.6.1 *Discussion—Fire-separating element* is defined in European building codes that cite ISO 10295-1 as the "floor, wall or other separating element of construction having a period of fire resistance determined in accordance with ISO 834-1." Test Method E1966 defines a *fire-separating element* as "n—floors, walls, and partitions having a period of fire resistance determined in accordance with Test Methods E119 or E1529."

3.2.7 *firestop device, n*—a mechanism designed to serve the special purpose of sealing around a *penetrating item* and perform the special function of resisting heat transfer, flaming and hot gases through it or the *penetrating item*.

3.2.7.1 *Discussion—Firestop devices* are *firestop materials* and are available in many types: for example, collars, grommets, plugs, raceways, covers, and others. A "*firestop device*" has the type and quantity of *firestop material* premeasured, thus eliminating some ambiguity that otherwise occurs with the manual measurements of *firestop materials*, such as with liquid sealant-based *firestop systems*.

3.2.8 *firestop material, n*—any component, excluding the *opening*, *annular space*, *fire-separating element*, and *penetrating items*, that is used in the *firestop system*.

3.2.8.1 *Discussion—Firestop materials* include the following: *fill material*, *firestop device*, *firestop sealant*, *forming material*, *packing material*, and *preformed firestop product*. *Firestop materials* also include subsets of the preceding defined terms including, but not limited to, the following: backing material (9.4.1), bond breakers (9.5.1), firestop collars (11.1), wrap strips (12.2), cable sleeve devices (13.2), firestop pillow (14.2), firestop brick (14.2), composite sheet (15.2), firestop putty (16.3), mortar (17.3), and firestop foam (18.3).

3.2.9 *firestop sealant, n*—a *firestop material* used to cover a surface or fill a void, or both, which is intended to prevent passage of a flame, heat, liquid, or gas.

3.2.10 *forming material, n*—specific certified product that is part of the *firestop system*.

3.2.10.1 *Discussion*—Typically, *forming materials* include, but are not limited to, mineral wool and ceramic fiber. These specific *firestop materials* are often deemed noncombustible by building codes using Test Method E136. When noncombustible *forming material* is required, a combustible material should not be used even if it is certified because its fire performance may not be equal to the tested material.

3.2.11 *horizontal assembly, n*—a ceiling, floor, or roof assembly that has a fire-resistance rating as determined in accordance with Test Methods E119 or a standardized test method with similar intent.

3.2.11.1 *Discussion—Horizontal assembly* is defined in the ICC International Building Code[13] as "a fire-resistance-rated floor or roof assembly of materials designed to restrict the spread of fire in which continuity is maintained."

3.2.12 *listing, n*—a publicly available document created by a technically qualified, independent, third-party agency that provides the requirements of an application of a specific *firestop system*, which was tested or assessed, and meets the requirements of Test Method E814 or another applicable *firestop system* test method.

3.2.12.1 *Discussion*—A *listing* is published by an organization acceptable to the *authority having jurisdiction (AHJ)* and it is concerned with the description of *firestop systems* and *firestop materials*, which are properly tested. The significance of a *listing* is dependent on the country issuing the *listing*. In some countries, a *listing* signifies that periodic and ongoing inspections of manufacturing facilities are conducted to determine whether the *firestop materials* maintain their quality under controlled manufacturing conditions. In other countries, a *listing* signifies that the manufacturer has attested (certified) to the materials and process used in the manufacturing process of the *firestop materials* tested as part of a *firestop system*. In addition, some countries require ongoing documentation supporting the original attestation: either limited manufacturing or on-site inspections, or both. *Listings* for *firestop systems* are sometimes described by different nomenclatures: such as "Design Numbers" by Intertek; "System Numbers" by UL, etc. Typically, the agency creating the *listing* will be recognized under ISO 17065 as a Certification Body, which ensures that the agency has the competence and impartiality needed to be a technically qualified and independent third-party.

3.2.13 *manufacturer's instructions, n*—one or more documents, which provide the conditions, limitations, and

specific procedures to properly use a *firestop material* during a *firestop system* installation, prepared by the producer of the *firestop material*(s).

3.2.13.1 *Discussion*—In many cases, the *manufacturer's instructions* are an intrinsic part of the published *listing* and are therefore not repeated in the *listing*, but are nevertheless just as important as other details that are stated in the *listing*.

3.2.14 *membrane penetration, n*—an *opening* only made into one side of a *fire-separating element*.

3.2.14.1 *Discussion*—"*Membrane penetration*" is defined in the ICC International Building Code[13] as "a breach in one side of a floor-ceiling, roof-ceiling, or wall assembly to accommodate an item installed into or passing through the breach."

3.2.15 *opening, n*—a hole made through or into a *fire-separating element*.

3.2.15.1 *Discussion*—When installing a *firestop system*, an *opening* is typically made to accommodate a *penetrating item* or a *firestop material*, or both. The concept of "*opening*" is used in the definition of *firestop system* but is not specifically defined in Test Method E814. The concept of *opening* includes both *membrane penetrations* and *through penetrations*. *Opening* as defined and used herein is also sometimes referred to as a "breach" or "penetration" in some building codes. Breach is not defined in the ICC International Building Code[13] but is used in the IBC[13] definitions related to *firestop systems*, some of which are cited or noted herein. However, the term penetration is used in other international codes and is defined in ISO 10295-1 as "an aperture[20] within a *fire-separating element* usually present to accommodate the passage of a service through that element."

3.2.16 *packing material, n*—a generic product that is part of the *firestop system*.

3.2.16.1 *Discussion*—A *packing material* is typically used in the same manner as a *forming material*. The only difference is that *forming material* is a certified product referenced by a specific trade name and manufacturer in the *listing*. The generic product classification of *packing material* is based on a generic product description in the *listing*. *Packing materials* include, but are not limited to, mineral wool and backer rod.

3.2.17 *penetrating item, n*—any part of an electrical, mechanical, plumbing, HVAC, or telecommunication service; a structural element (for example, beam or column); or any other element that the *opening* surrounds and is part of the *firestop system*.

3.2.17.1 *Discussion*—The concept of "*penetrating item*" is not specifically defined in Test Method E814 but it is referenced in the definitions of *firestop system*, *membrane-penetration firestop system* and *through-penetration firestop system*, with the latter citing some examples. Within this guide, the concept of *penetrating item* includes, but is not limited to, cables, conduits, ducts, and pipes, as well as recessed boxes/fixtures and structural elements, such as columns and beams.

3.2.18 *preformed firestop product, n*—the part of *firestop system* that does not require any curing time.

[20] An opening, hole, or gap.

3.2.18.1 *Discussion—Preformed firestop products* are *firestop materials* that include, but are not limited to, precast devices, cable pathway devices, wrap strips, firestop collars, firestop pillows, firestop blocks, and composite sheets, but not including firestop putties. A "*preformed firestop product*" has the type and quantity of *firestop material* pre-measured, thus eliminating some ambiguity that otherwise occurs with the manual measurements of *firestop materials*, such as with liquid sealant-based *firestop systems*.

3.2.19 *through penetration, n*—an *opening* that passes through a *fire-separating element*.

3.2.19.1 *Discussion*—"*Through-penetration*" is defined in the ICC International Building Code[13] as, "a breach in both sides of a floor, floor-ceiling, or wall assembly to accommodate an item passing through the breaches."

4. Significance and Use

4.1 The information contained in this guide is general in nature because of: the great number of commercially available *firestop systems* globally; the quantity and variety of internationally published *firestop system*'s *listings*; worldwide variations in building and fire code requirements; and the many conditions and applications associated with a *firestop system*'s use.

4.2 This guide provides general information and guidance that is primarily used by firestop contractors and *firestop industry inspectors* of a *firestop system*. However, this guide should also be used by others, such as architects, engineers, specifiers, etc. Some of the information referenced in this guide provides resources for additional information not contained in the manufacturer's installations, the *firestop system*'s test report, and *listing*. Information contained in this guide also allows a single source for a general comparison of *firestop materials* used during the installation of *firestop systems*.

4.3 This guide discusses general procedures, such as substrate cleaning and priming, as well as installation of the components of a *firestop system*.

NOTE 2—The term "substrate" has a particular meaning in engineering. A substrate is defined as the "basic surface on which a material adheres, for example, paint or laminate."[21]

4.4 This guide explains the general properties and functions of various *penetrating items* and *firestop materials*.

4.5 This guide presents general guidelines for the application of the various materials used in the installation of a *firestop system* for a specific application, and environmental conditions and effects that are known to potentially affect a *firestop system*'s installation.

4.6 This guide is intended to be read completely at least once, and each of the Sections 1 through 19 should be read in their entirety to avoid misunderstanding and misapplication.

4.7 This guide may[22] also provide some value to users of IMO Safety of Life at Sea (SOLAS) and other International

[21] McGraw-Hill Dictionary of Scientific and Technical Terms, Fifth Edition, 1994.

[22] "May" is used to indicate that a provision is optional.

Maritime Organization (IMO) documents, including the IMO FTP Code, on fire testing *firestop systems*, also known as "penetration systems."

4.8 This guide is not an all-inclusive document. It is intended to address common sources for planning, preparation, and installation of *firestop systems*. References to other documents made herein contain important information and details that provide more in-depth knowledge of *firestop systems* and their installation.

4.9 This guide does not provide all of the specific information that is typically described in test reports, *listings* or *judgments* with justifiable technical rationale for specific applications of *firestop systems*.

4.10 This guide is not a *firestop system*'s installation manual.

NOTE 3—The *firestop system*'s manufacturer should be consulted about applications for their *firestop materials*, including their proper storage, use, and installation.

4.11 This guide does not provide detailed information about the *firestop system*'s inspection process or provide specific information about *firestop industry inspector*'s qualifications and competence.

NOTE 4—Practice E2174 provides a method for on-site inspection of *firestop systems*. The ICC International Building Code[13] references Practice E2174 under requirements for special inspections. Practice E3038 provides information for assessing and qualifying candidates as *firestop industry inspectors* of *firestop systems* based on the candidate's competence.

4.12 Except as discussed in 6.8, this guide does not provide information about "blank *openings*," which involve an *opening* that is sealed with *firestop materials* but does not have any *penetrating items*.

4.13 Test reports, *listings*, and *judgments* with justifiable technical rationale do not normally contain all the information needed related to the aging, environmental, mechanical, and physical properties of the *firestop system*; or the longevity, durability, and performance of the *firestop system*. This guide offers some resources to ascertain this supplemental information because these characteristics can affect the *firestop system*'s installation and performance.

NOTE 5—Some information related to these performance characteristics of *firestop systems* or *firestop materials* is also found in: Test Method E2785, which tests for exposure of *firestop materials* to environmental conditions; Test Methods E2786, which measures expansion of intumescent materials used in *firestop systems*; and Practice E2923, which measures the relative movement capabilities of *through-penetration firestop systems*. Still, other performance characteristics of the *firestop system* can be specified that are not contained in *firestop system*'s test report or *listing* may also be required, such as surface flammability and smoke attributes determined by Test Method E84 or other similar standards (for example, CAN/ULC-S102, EN 13501-1, NFPA 255, UL 723, etc).

5. Overview of Contents in this Guide

5.1 This guide provides an international compendium of general information regarding *firestop systems* and *firestop materials*. It will save time in searching for the individual sources and compiling the information. In addition, many sources of supplementary information are cited regarding the *firestop system* or *firestop materials*, or both. Many additional sources to periphery installation information are referenced. All of this information should be useful to verify that the proper *firestop system* was designed, specified, selected, installed, and inspected.

5.2 This guide establishes common terminology for the firestop industry that should be applied internationally because most of these definitions are based on international standards and codes. These common definitions should help to increase international understanding of *firestop systems*.

5.3 This guide illustrates how a *firestop system* sometimes has to perform a multitude of functions: for example, fire resistance, water resistance, air leakage resistance, surface flammability resistance, smoke generation resistance, movement compatibility, environmental resistance, sound resistance, etc. This guide recommends planning procedures to help verify a proper *firestop system* installation, which helps avoid poor performance of an installed *firestop system*. This guide increases life safety and knowledge by increasing the industry's awareness of these many other functions that a *firestop system* sometimes has to perform simultaneously when properly installed. When these functions are obtained from differing test methods described in test reports and *listings*, conflicts between the installations of *firestop materials* should be discussed and resolved prior to installation of the *firestop system*.

5.4 This guide provides a summary of the various *firestop systems* and *firestop materials*, as well as their uses. These précises provide a quick reference for general comparison, which should assist in expediting selection of an alternate *firestop system* when field conditions have changed during the building's construction.

5.5 This guide offers general information for preparation of the *opening* and substrates, as well as general instructions regarding the storage and use of *forming materials* and *packing materials*. This information provides the firestop contractor and others a general reference document.

5.6 This guide also presents some "tricks-of-the-trade" and observations when preparing for and conducting the installation of a *firestop system*. These annotations should assist in reducing the installation time and help avoid compatibility conflicts between installation materials and the *firestop materials* being used together.

6. General Information

6.1 *Firestop systems* are used throughout the world and are identified by other terms in other industries (for example, "penetration systems"). Therefore, it is important to have a basic understanding of general information that could affect the installation of *firestop systems*. This guide may also help those purchasing an installed *firestop system* understand the amount of time and supplemental materials that the firestop contractor has to provide in order to achieve a quality installation.

6.2 *Firestop systems* are composed of parts. The first part is a *fire-separating element*. The second part is an *opening* created through or into a *fire-separating element*. When the *opening* is only into one side of the *fire-separating element*, the

firestop system needed is called a *membrane-penetration firestop system*. When the *opening* is completely through the *fire-separating element*, the *opening* is called a *through-penetration* and the *firestop system* needed is called a *through-penetration firestop system*. When the *opening* is not completely through but into one side of the *fire-separating element*, the *opening* is called a membrane-penetration and the *firestop system* needed is called a *membrane-penetration firestop system*. The next extremely important part of a *firestop system* is at least one *penetrating item* (for example, electrical, mechanical, plumbing, telecommunication, or other service; or a structural element (for example, beam column, etc.) that passes through or into the *opening*. The last part of a *firestop system* is the application of one or more *firestop materials*.

6.3 Understanding relevant terminology is also critical in comprehending the *firestop system*'s test report or *listing* to verify proper *firestop system* installations. Test Method E814 and the other North American test methods use the terms F-Rating and T-Rating to describe limitations ascribed to flaming and temperature limitations, respectively, on the unexposed surface of the *firestop system*. However, most other countries use the terms integrity and insulation to determine flaming and temperature limitations, respectively.

6.4 In addition, UL 1479 has an optional L-Rating to assess air leakage as well as an optional W-Rating to evaluate water resistance. Some in the industry refer to this optional L-Rating test as smoke leakage or cold smoke leakage. CAN/ULC-S115 also has an optional L-Rating. However, no other test methods for *firestop systems* include these optional performance ratings: L-Rating and W-Rating. The test report or *listing*, or both, should specially state an L-Rating for the *firestop system* to be considered as smoke resistant. The test report or *listing*, or both, should specially state a W-Rating to be considered as water resistant.

NOTE 6—Throughout most of the world, *firestop system* and *fire-resistive joint system* requirements for fire performance are denoted in separate test methods. CAN/ULC-S115 is a unique standard in that it references both *firestop systems* and *fire-resistive joint systems* called joint *firestop systems* in one standard. However, this guide only addresses a *firestop system* as defined in CAN/ULC-S115.

6.5 To verify proper *firestop system* installations, the origin of the documents related to installation is extremely important. Sometimes *judgments* with justifiable technical rationale are used as the basis of *firestop system* installations when the test report or *listing* does not address the specific project application of a *firestop system*. Since *judgments* with justifiable technical rationale are one of the installation sources, their origin is very important to verify that the *firestop system* installation is in compliance with the project and code requirements. Often a *judgment* with justifiable technical rationale is used in lieu of *firestop system*'s test report or *listing*, or both. Therefore, it is important to know that fire test standards for *firestop systems* used in other countries are similar but not identical. For example, all fire test standards for *firestop systems* require a positive furnace pressure. However, the degree of positive pressure varies greatly between the requirement in the United States and other countries. This is important information when *firestop system*'s test reports and *listings* are assessed to create *judgments*. This is also true of other conditions of these test standards used to fire test *firestop systems*.

6.6 Some *listings* declare that the *manufacturer's instructions* be followed for installation of the *firestop system*. It is possible that the *manufacturer's instructions* have changed from the time of fire testing and publication of the *listing*. Therefore, to assure the *manufacturer's instructions* are unchanged or still applicable, the *manufacturer's instructions* should be verified with the manufacturer or agency publishing the *listing* before beginning the *firestop system* installation process. Ideally this verification process should take place when a *firestop system* is being specified to avoid project delays once the work is awarded. The *manufacturer's instructions* should also bear revision dates, which will assist in the verification process.

6.7 North American *firestop system* test methods (for example, Test Method E814, UL 1479, and CAN/ULC-S115), contain a requirement for a hose stream test. In the United States, the application of the hose stream is basically conducted in compliance with Practice E2226. Other international test standards for fire testing *firestop systems* do not mandate or include a hose stream test. Using a *judgment* with justifiable technical rationale in the United States, based on fire testing without the hose stream test, could affect the intended performance of an installed *firestop system*.

6.8 "Blank *openings*" are not part of this guide because these types of *openings* do not have *penetrating items*, which is a necessary part of a *firestop system*. However, much of this guide contains helpful information about the *opening* and the installation of *firestop materials*. Sometimes a blank *opening* is actually a *fire-resistive joint system*, which should be tested in accordance with Test Method E1966, Test Method E2307, Test Method E2837, or similar test standards.

6.9 Fire testing to Test Method E814, or similar test standards, does not replicate every project's environment and installation conditions. In the laboratory, the *firestop system* has been subject to the laboratory's environmental and installation conditions. This laboratory environment could be different from that of the field installation of a *firestop system*.

6.10 Fire testing to Test Method E814, or similar test standards, provide a comparative measure of the fire performance of *firestop systems*. Testing *firestop systems* is based on a standardized fire exposure called a time-temperature curve. This practice is used worldwide and standardized fire tests are the basis of many building codes. However, this standardized fire exposure is not representative of all fire conditions because conditions vary with changes in the amount, nature, and distribution of fire loading, ventilation, compartment size and configuration, and heat sink characteristics of the compartment. Any variation from the test conditions or *firestop system*, such as size, materials, or method of assembly, can affect the fire-test-response. Therefore, every real-world fire that an installed *firestop system* can encounter is not represented by any fire test. The real-world fire can be less, or more, severe in intensity or duration, or both.

6.11 Test methods try to limit the number of variables (fire exposure, thermocouples, temperature measurements, etc.) encountered in a fire test. Fire tests conducted by a laboratory use the materials and construction designated by the test sponsor for the *fire-separating element*.

6.12 Fire testing the test assembly is intended to assess materials, workmanship, and details such as dimensions of parts, and built under conditions representative of those applied in building construction and operation. However, these variables in actual construction are enormous. Therefore, the *fire-separating element* on a particular project tested with a *firestop system* is not typically representative of every construction for every project. For example, concrete type and mix used in building construction varies considerably. The *fire-separating element*'s construction could be standardized using standardized materials and construction practices to allow for a broader application of the test report and *listing*. Using a standardized generic concrete type (for example, siliceous, carbonate, sand-lightweight, or lightweight) at a thickness slightly less than needed for the prescribed fire-resistance rating would potentially qualify other concrete types. These types of evaluations should be conducted by qualified individuals using general principles contained in ACI 216 and Practice E2032 and can reduce the construction variables to a reasonable number.

6.13 Sometimes the specified project conditions change. This situation sometimes requires changing the specified *firestop system*. This guide can be used as a general reference to ascertain whether the installation of another *firestop system* may be compatible with the changed condition. For example, the original *opening* was to be relatively small; have only one *penetrating item*; and be sealed with a *firestop sealant*. However, well after construction has commenced, the building owner instructs the architect that the building is intended to have the ability for retrofitting to satisfy each building occupant's special electrical, mechanical, plumbing, or telecommunication needs. Therefore, the existing *opening* should be made considerably larger and the *firestop material* should be capable of being easily removed and replaced to reduce the inconvenience to the building occupant when changes are made to accommodate new or additional services requested.

6.14 Proper installation of the *firestop system* is dependent on conformity to the *firestop system*'s test report or *listing*; the *manufacturer's instructions* when they are not in conflict with the *firestop system*'s test report or *listing*; and the firestop contractor's competence and due diligence. Ideally the *firestop system* should be based on a test report or *listing*, which has been reviewed prior to specifying the *firestop system*. When a *firestop system* is specified based on a *judgment* and the installation procedure differs from the typical *manufacturer's instructions*, the manufacturer should provide special installation instructions for that specific application.

6.15 Manufacturers test their products in accordance with many different standards to ascertain physical properties and performance data. This test information becomes part of their technical data sheets, which are used in the selection and specification of *firestop materials*. Proper fire testing, selection, and specification of *firestop materials*, installation, and inspection (during or after installation, or both) are fundamental to the *firestop system*'s longevity, durability, and performance. The installation is dependent on expertise and quality of workmanship by the firestop contractor. The inspection is based on the quality of inspection standards as well as the *firestop industry inspector*'s competence and due diligence.

7. Planning Procedures

7.1 Many times the experience of the firestop contractor and *firestop industry inspector* can help identify and avoid potential issues associated with the installation of the *firestop system*. The following sections are areas where their experience should be of benefit to the *authorizing authority (AA)* and proper installation of *firestop systems*.

7.2 *Planning for the Firestop System Installation:*

7.2.1 When there is a designated firestop contractor or a specific building trade installing the *firestop system*, coordination by means of a pre-construction meeting should take place between those installing *firestop materials* and the building trades that are creating the *opening*. Ideally, such coordination should take place as early in a project as possible, such as during the review of pre-tender and pre-construction drawings by the firestop contractor or the specific building trade installing the *firestop system*. Proper planning decreases the likelihood of field modifications during the installation of the *firestop system*, which can cause project delays and increase costs.

7.2.2 The pre-construction meeting should include the plumber, electrician, carpenters, mechanical trades (for example, those installing HVAC ducts and kitchen exhaust ducts because information in NFPA 90A and NFPA 96, respectively, often affects installation of *firestop systems*) and any other party that impacts the installation of the *firestop system*. Any limitations (for example, location, size, shape, configuration, or other details) of the *firestop system*'s *opening* should be discussed and any potential conflicts or issues addressed. This facilitates coordination of utilities, their location, and the *openings* to accommodate the *firestop system*.

7.2.3 The orientation of a *penetrating item* through a *fire-separating element* should be planned ahead of time. The *penetrating item* should be installed perpendicular to the *fire-separating element*. This orientation allows a larger selection of *firestop system*'s *listings* to be considered, which typically allows the *firestop system* installation costs to be minimized.

7.2.4 When the *penetrating item* is not installed perpendicular to the *fire-separating element*, the possibility increases that a *firestop system*'s test report or *listing* does not exist for this angled orientation of the *penetrating item*.

7.2.5 Some *firestop systems*' *listings* allow some metallic *penetrating items* to pass through the *opening* at an angle to the *fire-separating element* when the *firestop system* consists of at least a *fill material*. When available, the user of this guide should refer to a laboratory's guide information[23] about their *listings* for more information about angled *penetrating items*.

[23] For example: UL's XHEZ GuideInfo Through-penetration Firestop Systems, http://productspec.ul.com/document.php?id=xhez.guideinfo.

7.2.6 When time and flexibility for planning of *openings* exist, consideration should be given to the following guidelines for *openings* using frangible materials such as gypsum board.

7.2.6.1 The *opening* should be made as close as possible to a framing member.

7.2.6.2 Adjacent *openings* should be spaced apart as far as possible from each other.

7.2.6.3 The clear space between adjacent *openings* should be adequate to maintain the fire-resistance rating (insulation, integrity, and stability) of the *fire-separating element* before the *opening* was created.

7.2.6.4 *Openings* should be spaced apart as far as possible from structural members (for example, beams, columns, joists, etc.) to minimize the possibility of creating interference between the *firestop system* and fire-resistive materials (also known as fireproofing) such as Sprayed Fire-Resistive Material (SFRM) and Intumescent Fire Resistive Materials (IFRM), etc., applied to structural members.

7.2.7 When time and flexibility for planning of the *opening* exist, consideration should be given to the following guidelines for *openings* in a *fire-separating element* constructed of cement-based materials, such as poured in place concrete, Concrete Masonry Unit (CMU), precast concrete sections, or hollow core precast concrete sections.

7.2.7.1 Adjacent *openings* should be spaced apart as far as possible from each other.

7.2.7.2 The clear space between adjacent *openings* should be adequate to maintain the fire-resistance rating (insulation, integrity, and stability) of the *fire-separating element* before the *opening* was created.

7.2.7.3 *Openings* should be spaced apart as far as possible from structural members (for example, beams, columns, joists, etc.) to minimize the possibility of creating interference between the *firestop system* and fire-resistive materials (also known as fireproofing such as SFRM and IFRM, etc.) applied to structural members.

7.2.8 Whenever possible, noncombustible (for example, metal) and combustible *penetrating items* should be routed through separate *openings*. When multiple *penetrating items* of noncombustible and combustible materials are to be commingled within the same *opening*, this combination tends to make finding a *firestop system*'s test report or *listing* and installing the *firestop materials* more complicated and possibly more costly. These difficulties are due to the differing *firestop systems*' requirements for noncombustible and combustible items.

7.2.9 Complex situations using a combination of differing types of *penetrating items*, which have not been tested together within a single *opening*, should be avoided by recommending that the *penetrating items* of each service be separated into individual *openings*. A *firestop system*'s test report or *listing* addressing this commingling of *penetrating items* is typically not available. The commingling of different types of *penetrating items* in one *opening* may be acceptable where a *firestop system*'s test report or *listing* matching the proposed condition is identified during the planning stage to accommodate the specific combination of *penetrating items*.

7.2.10 In planning the size of an *opening*, consideration should be given to the minimum and maximum *annular space* dimensions required in order to be able to use either a *firestop system*'s test report or *listing* for that specific application. When available, the user of this guide should refer to a laboratory's guide information[23] about their *listings* for more information about understanding *annular space*. Proper planning decreases the likelihood of field modifications during the installation of the *firestop system*.

7.2.11 In planning the location of a *penetrating item* with respect to its location in the *opening* (for example, centered, eccentric), the proposed *penetrating item*'s location that is detailed in either a *firestop system*'s test report or a *listing* is extremely important and should be verified.

7.2.12 *Firestop materials* from different manufacturers should not be mixed within one *firestop system*, unless that combination is specified in either a *firestop system*'s test report or *listing*.

NOTE 7—*Firestop materials* of one manufacturer usually have been tested for compatibility with each other, whereas compatibility between *firestop materials* from different manufacturers is typically unknown.

7.2.13 A *through-penetration firestop system* or a *membrane-penetration firestop system* should not be installed through or into a *fire-resistive joint system* unless a *firestop system*'s test report or *listing* exists for this specific condition. Most *fire-resistive joint systems* are designed to move (for example, expand and contract). The addition of a *firestop system* can alter the required and tested movement capabilities of the *fire-resistive joint system*. Movement can also diminish the long-term stability of the *firestop system* potentially changing the fire-resistance rated performance of the *firestop system*.

7.2.14 The fire-resistance rating can be adversely affected when the *penetrating item* is routed through a tested *fire-resistive joint system*. Whether the *firestop system* meets the required limitations of Test Method E1966, or other similar test methods (for example, AS 4072.1, BS 476-20, EN 1366-4, ISO 10295-2), when commingled with a *firestop system* is extremely important and should be verified. These limitations include limiting heat transmission and prohibiting flaming as well as the passage of hot gases. In addition, the *fire-resistive joint system*'s fire-resistance rating and the *firestop system*'s fire-resistance rating should be equal and based on the most severe code requirements.

7.2.15 When the *penetrating item* is routed through a perimeter joint protection or continuity head-of-wall joint system, which are other types of tested *fire-resistive joint systems*, the same limitations and requirements cited in 7.2.13 and 7.2.14 should apply.

NOTE 8—Perimeter joint protection is defined in Test Method E2307 as "n—a *fire-resistive joint system* located between the exterior wall assembly and the *horizontal assembly* that fills the perimeter joint." Continuity head-of-wall joint system is defined in Test Method E2837 as "n—materials or devices, or both, installed to resist the spread of fire for a prescribed period of time through the joint *opening* between a fire-resistance rated wall assembly below and nonrated *horizontal assembly* above."

7.2.16 A *through-penetration firestop system* should not be installed through a ceiling membrane unless either a *firestop*

system's test report or *listing* to accommodate that type of installation exists for the specific application.

7.2.17 Locating *openings* through lateral or longitudinal butt joints of gypsum board in a *fire-separating element* should be allowed when appropriate information exists that this location will not diminish the fire-resistance rating of the *fire-separating element*.

7.2.18 When a temperature rating (for example, T-Rating) is required for the *firestop system* contained in a *fire-separating element*, whether the *firestop system* provides the needed temperature rating is extremely important and should be verified.

NOTE 9—Building codes in the United States do not require T-Ratings for *firestop systems* installed in a *fire barrier*. When a building code requires a T-Rating for a *firestop system* installed in a *fire barrier*, finding a *firestop system*'s test report or *listing* that provides the needed T-Rating is extremely important. For example, building codes citing ISO 10295-1 and EN 1366-3 as the *firestop system* test method require an insulation rating (also known as T-Rating).

7.2.19 For *fire barriers* forming the walls of a shaft, a *firestop system* that requires installation of *firestop sealant* on the interior of the shaft, a recommended sequence for the installation of a *firestop system* should allow access to the interior of the shaft prior to the application of the exterior side of the shaft. Inspection of this type of *firestop system* installation should verify that the *firestop sealant* on the interior of the shaft is properly installed. This inspection often requires viewing the *firestop sealant* on the interior of the shaft before the exposed membrane (also known as panel or sheathing) is applied. Where access to the interior of the shaft is impractical, the *firestop system* selected for shaft applications should not require a *firestop sealant* be installed to the interior of the shaft side (inaccessible side).

NOTE 10—A shaft is a long, narrow, typically vertical hole that gives access to a building's services (for example, communications, mechanical, electrical, HVAC, plumbing, etc.), or accommodates an elevator in a building.

7.2.20 *Firestop materials* should not be used to support the *penetrating items*, unless this function was performed when fire tested. After installation is complete, with the discovery of a *firestop material*(s) supporting (but not tested for this condition) the *penetrating item*(s), additional support should be provided to eliminate the load of the *penetrating item*(s) bearing on the *firestop materials*.

7.3 *Planning for Movement of Penetrating Items:*

7.3.1 When significant relative motion between the *penetrating item* and the *fire-separating element* is expected during sealant cure, the following approaches can help mitigate the risk of movement-during-cure damage. They generally fall into one or more of the following options:

7.3.1.1 Accelerate sealant cure rate, or

7.3.1.2 Reduce relative movement, or

7.3.1.3 Use of *preformed firestop product*, or

7.3.1.4 Use another appropriate method to mitigate risk, or

7.3.1.5 Inspect the firestop system after the movement event is complete and repair damage that may have occurred.

NOTE 11—There are *preformed firestop products* that can be used in lieu of a liquid-applied *firestop sealant*. In general, *preformed firestop products* can be installed in the *opening* under compression, friction fit, adhered in place, cast in place, or secured to with a mechanical attachment to the *fire-separating element*. *Preformed firestop products* have been used successfully to seal a *firestop system* in lieu of a liquid-applied *firestop sealant* that would experience detrimental movement-during-cure.

7.3.2 The user of this guide should understand that any movement during cure of the *firestop sealants* may result in damage that is required to be repaired. Manufacturers should be able to provide the user with guidance or status of the cured state based on jobsite environmental conditions.

NOTE 12—In general, a multi-component *firestop sealant* tends to cure at a faster rate than a single-component *firestop sealant*. Some *firestop sealant* manufacturers produce a fast cure single-component *firestop sealant*. The *firestop sealant* manufacturer makes a *firestop sealant* recommendation, for a particular application that involves movement-during-cure. Atmospheric conditions impact the curing time. Curing time is more strongly impacted by atmospheric conditions for single-component sealants.

7.3.3 When possible, the *penetrating item*(s) should be firmly braced, either temporarily or permanently, to the *fire-separating element* to prevent relative movement. This bracing results in movement of the *penetrating item* being shifted temporarily to the length of *penetrating item* beyond the point of bracing. *Firestop sealant* can then be installed in the braced arrangement of *penetrating item* and the *fire-separating element*. Following appropriate cure of the *firestop sealant*, removal of the temporary bracing should be performed. Another approach that could be considered is to delay *firestop sealant* installation until after a likely disturbance of the *penetrating item*(s) has passed.

7.3.4 When the *penetrating item* is not supported by the *horizontal assembly* and its deflection is anticipated, then there is no practical way to prevent movement during cure. Proper selection of a *firestop system* might not include the use of *firestop sealants*.

7.3.5 Applications where the flow of cold or hot fluids through a pipe produce movement during a *firestop sealant*'s cure is typically unavoidable, there is no practical way to brace the pipe against movement. Proper selection of a *firestop system* for this application might not include the use of *firestop sealants*.

7.3.6 In most situations when movement is anticipated (whether from expansion, contraction, vibration, disturbance, or other source) and prevention of relative movement between the *penetrating item* and the *fire-separating element* is not a feasible solution, proper selection of a *firestop system* might not include the use of *firestop sealants*.

7.3.7 For applications where relative movement between the *penetrating item* and the *fire-separating element* is expected during the life of the building, solutions that include bracing should be a consideration; *preformed firestop products*; or *firestop sealants* that are designed move when tested to Test Method E3037. *Firestop sealant*'s movements determined by Test Method E3037 should be compatible with the relative movement between the *penetrating item* and the *fire-separating element*.

NOTE 13—The *firestop sealant* manufacturer should be consulted when a *firestop system* that uses a liquid-applied *firestop sealant* around the *penetrating item*(s) and movement can be successfully prevented during