

Firestopping Inspection Manual

- Through Penetrations
- Fire Resistive Joints
- Perimeter Fire Barrier Systems
- Fire-Rated Duct Enclosures



**International
FireStop Council**

The Source of Firestop ExpertiseSM



**Inspector
Pocket Guide
Fifth Edition**

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of
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Fifth Edition



Install

Inspect

Correct

The Source of Firestop ExpertiseSM

Inspector Pocket Guide



The following information is intended to provide construction and code enforcement professionals with basic checkpoints to ensure that the required fire resistance ratings are maintained when through penetrations and linear joints breach walls and floors.

This inspection guideline is not intended to be all encompassing or to be used as a design guide. It is for information and educational purposes only.

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Building Code Requirements



Construction codes have very clear requirements on passive fire protection. These requirements are included in Chapter 7 Fire and Smoke Protection Features of the International Code Council (ICC) International Building Code® (IBC®).

Whenever required by the IBC®, the fire resistance ratings of floors, walls, floor/ceiling, roof/ceiling assemblies or fire-resistance-rated duct enclosures must be restored when an opening is made to accommodate penetrations for mechanical, electrical, plumbing, communication systems and ventilation ducts. joints between floors, walls, floors and walls, etc, must also have the same fire resistance ratings as the adjacent construction.

NFPA 101 (Life Safety Code), NFPA 70 (National Electric Code), the International Mechanical Code® (IMC®) and the International Plumbing Code® (IPC®) also include provisions related to the protection of penetrations. The codes have explicit requirements for inspection of firestop systems before they are concealed.

The IBC 2012 107.2.2 requires that evidence be submitted to the building official showing that the materials and methods of construction used to protect penetrations, joints and ventilation ducts in fire resistance rated building elements shall not reduce the required fire resistance rating. The International Fire Code® has requirements for periodic inspection of firestop systems throughout the life of the building.



Plans Examination / Review

The authority having jurisdiction (AHJ) must review and approve firestop system details and rated ducted enclosures. Hence, firestop systems details and materials must be included on the plans and specifications. Manufacturer's cut sheets are often accepted if they are generated by an approved testing agency. If details, products and specifications are not sufficient to provide clear directions to the general contractor and firestop installer, the submittals should be noted as incomplete and returned to the designer to be resubmitted with the required information. If the plans and specifications are clear and complete, most field problems with firestop systems can be avoided.



Engineering Judgments



It is not unusual to find, in construction projects, unique conditions which have not been tested and listed, that require special consideration. The protection of these conditions will necessitate Engineering Judgments (EJ's) since they have not been tested and do not comply with a published design listing.

The International Firestop Council has published "Recommended IFC Guidelines for Evaluating Firestop Systems in Engineering Judgments" to assist designers, plan reviewers and inspectors in addressing nonconforming construction details. The plan submittals should always indicate which details are based on EJ's. The submitted EJ's need to be approved by the building official, and made available to the field inspector when approved.

The IFC guidelines for the evaluation of EJ's can be obtained from the IFC website: www.firestop.org



Inspection Process



The time allocated for inspections can be drastically reduced if the proper paperwork is provided on the approved plans. Planning and communication between the building designer, structural engineer and the installer prior to construction will save time, costs and resources in assuring the application of the proper systems.

Verification of system testing and listings with a nationally recognized laboratory, prior to installation in the field, is key to a smooth inspection process. Use of applicable ASTM practices will provide guidelines for inspection of installed systems.



Field Inspection Process



The ability of penetration firestop systems, fire resistive joint systems and ventilation systems to perform their intended function of fire containment is directly related to the quality of their installations. Thorough inspection is an integral component of any passive fire protection quality control program. It is not realistic to visually inspect each penetration and the entire length of every joint and ventilation duct. How many inspections are enough? This is a judgment call by the inspector; however, the ASTM inspection standards may be used as a guideline.

Major elements of quality firestop inspections are:

- Firestop systems must not be concealed from view before being inspected and approved (IBC 110.3.6).
- Walk through visual inspections should be made during the rough and final inspections.
- When necessary or required, destructive evaluation will be made on various types of firestop systems.
- Appropriate tools for firestop inspections should include a flashlight, measuring device and cutting tool.
- Proper material depths, annular space, attachments, spacing and product type are critical to the effectiveness of the system.

- Construction documents detailing the fire-stop locations and systems must be kept on site to assist in the conduct of the inspection.
- Insure to a reasonable degree that empty containers, wrappings or boxes of the specified materials are in sufficient quantity to have been installed correctly.
- Insure to a reasonable degree that the actual products, containers, wrappings or boxes are labeled with the approved testing agency marks and are as specified in the submitted details.
- Measure the depth and width of materials as indicated in the details (sometimes density measurements are also required for products such as thermal insulation).
- Insure to a reasonable degree that joints have been installed in such manner that the required movement can be achieved.
- Compare the installed firestop system with the approved submitted details.
- Insure a reasonable degree of workmanship, which would indicate compliance with the specified design.



For Penetration Firestop Systems

Step One:



Verify the documents and submitted drawings reference tested and listed applicable through and membrane penetration assemblies containing sealants, devices and/or other materials tested to ASTM E814 or UL 1479 by accredited testing agencies. These systems should be published and readily available via the internet or other means.

Step Two:



Verify that the Through-Penetration System being used has been tested to the hourly rating necessary (ie. 1 hr., 2 hr., etc.) based on the type of assembly being penetrated.

Step Three:



As an overview of these steps, verify that the parameters indicated in the system are the same as those installed in the field: Is the through penetration system rated for the type and nature of assembly (thickness of concrete, stud width, etc.)?



Overview:

- A. Is the rating of the through penetration system equal or greater than the assembly penetrated?
- B. Do the supplied products have labels from a recognized quality assurance agency?
- C. Does the field installation follow the listing?

a. For the size of opening prior to firestopping?

b. For pipe conditions: Nature and quantity of penetrant(s), (material, size, diameter, insulation type & thickness, etc.)?

For cable conditions: Allowable cable sizes, jacketing, spacing and bundle size or percent fill of opening (as listed)?

c. Annular space requirements, (minimum, maximum, nominal, etc.)?

d. Specified forming, packing or backing material, (when required)?

e. Specified sealant, coating, device or firestopping product indicated, (type, amount, depth, location, etc.)?

f. Specified accessory items, (anchors, fasteners, securing devices, plates, etc.)?



For Fire Resistive Joint Systems: Including Mechanical Fire Barrier Systems

Step One:



Verify the documents and submitted drawings reference tested and listed fire resistive joint systems tested to ASTM E1966 or UL 2079 by accredited testing laboratories or certified third party testing agencies. These systems should be published or readily available via the internet or other means.

Step Two:



Verify the documents and submitted drawings have been reviewed by the Project Design Professional and/or the structural engineer and that they meet the allowable movement requirements.

Step Three:



Verify the documents and submitted drawings reference systems that have been tested for the required amount of movement. A system listing a nominal 1 inch joint width with 25% compression or extension, actually allows for a movement of 1/4" of compression and 1/4" of extension.

Step Four:



Verify the rating of the joint system is equal to the rating of the assemblies it is connecting. The code requires that the rating of a joint system shall not be less than the fire resistive ratings of the adjacent assemblies.



Overview:

As an overview of these steps, verify the parameters indicated in the system are the same as those installed in the field: (Download checklist form at the IFC web site www.firestop.org).

- A. Is the joint system tested and listed?
- B. Is the joint system tested for the amount of movement required?
- C. Is the joint system tested for the class and type of movement required?
- D. Is the fire rating of the joint equal to (or greater than) the assemblies it is adjacent to?
- E. Observe the nominal installed width of the joint at the framing inspection.
- F. If a mechanical system is used, are the specified tracks installed with a third party testing agency label attached?
- G. Do the supplied products have labels from recognized quality assurance agency?
- H. Does the field installation follow the listing?
 - a. Specified forming, packing or backing material?
 - b. Specified type of sealant, coating or device?
 - c. Specified amount, depth, location of sealant, coating or device?
 - d. Specified accessory items – cover plates, bond breaker tape, and specified deflection track?



For Perimeter Fire Barrier Systems (Curtain Walls)

Step One:



Verify documents and submitted drawings reference legitimate listed Perimeter Fire Barrier Systems. Documents referencing only fire resistive joint systems such as FF, FW or HW should not be accepted for curtain wall applications.

Step Two:



Verify the rating of the system is greater than or equal to the rating of the floor. The continuity requirements within the building codes state that the rating of a floor assembly must extend to and be tight against an exterior wall.

Step Three:



Verify that the firestop material to be used is classified and listed for use in Perimeter Fire Barrier Systems. All other materials should not be used.



Step Four:



Verify documents reference systems that have been tested with windows or vision glass if the building has glazing close to the safing area. Some systems were tested with glazing close to the safing area while other systems were for structures with limited glazing such as storage and warehouse facilities.

Step Five:



Verify a stiff steel reinforcement member, if required, has been placed behind exposed curtain wall panel insulation. Typical stiffening members can be steel hat channels, "L" or "T" angles.

Step Six:



Verify insulation type and brand used is listed within the tested system. Mineral wool is the typical insulation of choice. If mineral wool is used it must be installed to the correct compression and according to the correct orientation.

**Step Seven:**

If required by the tested system, verify insulation panels are securely fastened with mechanical fasteners per the listed system.

Step Eight:

Verify that exposed mullions, if required by the system, are covered with the proper insulating barrier securely fastened with mechanical fasteners per the system design.

Step Nine:

Verify safing clips or "Z" clips have been used if the system requires it.

Step Ten:

Verify coating or sealant has been applied to the proper depth. A common inspection practice is to be on site just prior to the addition of the sealant to verify the correct application thickness is being followed and to verify correct orientation of mineral wool. The inspector may request samples from the installing contractor after which the installing contractor shall make the necessary repairs to the destructively sampled area. A scale or caliper is sufficient for measuring the sealant depth.

**Overview:**

As an overview of the above steps, verify the parameters indicated in the system are the same as those installed in the field: (Download checklist form from the IFC web site at www.firestop.org).

- A. Is the perimeter fire barrier system tested for the type and nature of assembly, (minimum thickness of concrete, transom spacing, etc.)?
- B. Is the rating of the perimeter fire barrier system equal or greater than the floor assembly?
- C. Do the supplied products have labels from a recognized quality assurance agency?
- D. Does the field installation follow the listing?
 - a. Width of gap between floor edge and curtain wall at time of installation.
 - b. Design detail includes vision glass if applicable.
 - c. Specified curtain wall spandrel insulation, (type, thickness, density, etc.).
 - d. Specified spandrel panel perimeter angles, (gauge thickness, dimensions, fastener spacing).
 - e. Specified framing and/or mullion covering, (type, thickness, density, etc).
 - f. Support clips for safing insulation, if specified.
 - g. Specified forming or safing insulation, (type, % compression, depth, etc).
 - h. Specified sealant, coating, device or firestopping product, (type, depth, location).



For Fire-Resistance-Rated Duct Enclosure Systems

Step One:



Verify the documents and submitted drawings reference legitimate fire resistive duct enclosure systems tested by accredited testing laboratories or certified third party testing agencies. These systems and insulation components should be listed, labeled, published and readily available via the internet or other means.

Step Two:



Verify the duct enclosure system is tested to the appropriate Standard for the specific type of duct system. Grease duct enclosure systems are tested and listed per ASTM E2336, which includes a full scale ASTM E 119 engulfment test. HVAC duct enclosure systems are tested and listed per ISO 6944, Type A is for closed duct systems and Type B is for duct systems that contain openings.

Step Three:



Verify the fire resistance rating of the duct enclosure system and corresponding firestop system are equal or greater than the required fire resistance ratings for the building construction assembly penetrated.

For grease ducts, the IMC requires the fire resistance rating of the duct enclosure system be at least equivalent to the surrounding building



construction assembly penetrated. The F and T ratings for the corresponding duct firestop system must also be at least equivalent to the duct enclosure system and the surrounding assembly. For HVAC ducts, the stability, integrity and fire resistance rating of the duct enclosure system must be at least equivalent to the rating of the construction assembly penetrated.



Step Four:

Verify the field installation is consistent with the parameters of the listing and therefore compliant.

- A. Duct System Type – kitchen grease exhaust, hazardous material exhaust, ventilation, supply/ return, etc.
- B. Duct Construction – dimensions, material, gauge, reinforcement, connections, vertical or horizontal orientation.
- C. Enclosure System – labeled components, number of layers, fire rating, required clearance to combustibles, thickness and density of material, material joints (overlap of material, taping of cut edges or seams), etc.
- D. Enclosure System Attachment – mechanical method of attachment to duct (typically steel banding and/or capacitor discharge insulation pins), components, spacing, gauge, etc.
- E. Duct Supports – hanger system components, frequency of location, clearance to enclosure system, protection requirements.
- F. Access Door – field fabricated or prefabricated door construction and protection with enclosure system material must match design listing.
- G. Firestop System – refer to design listing for fire rated assembly construction, annular space, packing material type and depth, and firestop material type and depth.



Plan Review And Inspection Guidelines For Firestop Systems

Applicable Standards:



Test Standards relevant to Firestop Systems:

1. ASTM E 814 (ANSI/UL 1479) "Standard Test Method for Fire Tests of Through-Penetration Fire Stops"
2. ASTM E 1966 (ANSI/UL 2079) "Standards Test Method for Fire-Resistive Joint Systems"
3. ASTM E 1399 "Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems"
4. ASTM E 2174 "Standard Practice for On-Site Inspection of Installed Fire Stops"
5. ASTM E 2307 "Standard Test Method for Determining the Fire Resistance of Perimeter Fire Barrier Systems Using the Intermediate Scale, Multi-Story Test Apparatus"
6. ASTM E 2393 "Standard Practice for On-Site Inspection of Installed Fire Resistive Joint System and Perimeter Fire Barriers"
7. ASTM E 2336 "Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems"
8. ISO 6944 "Fire Resistance Tests – Ventilation Ducts"
9. ICC ES AC179 "Acceptance Criteria for Metallic HVAC Duct Enclosure Assemblies"
10. ASTM E-2750 "Standard Guide for Extension of Data from Firestop Penetration System Tests Conducted in Accordance with ASTM E814"



Independent Testing Laboratories



Third Party Testing Agencies:

There are several independent testing laboratories, also referred to as third party testing agencies, which conduct the fire testing of firestop, perimeter fire barrier and duct enclosure systems. The fire test results are usually included as design listings in the fire resistance directories published by the testing laboratory. These Directories are an important source of information during the plan review process and inspection process. The following are some of the recognized independent laboratories conducting tests of firestop systems:



1. Underwriters Laboratories Inc.
Northbrook, IL
(847) 272-8800
www.ul.com



2. Southwest Research Institute
San Antonio, TX
(210) 522-2311
www.fire.swri.org



3. Factory Mutual
Norwood, MA
(781) 762-4300
www.fmglobal.com



4. Intertek Testing Services
San Antonio, TX
(210) 625-8100
www.intertek.com



Firestop Systems Identification Guide

Penetrations:



Penetrant	Concrete Floor		Concrete Wall	
	UL	ITS	UL	ITS
Blank Openings	CAJ 0###	FS500-699FG	CAJ 0### WJ 0###	FS500-699WG
Metallic	CAJ 1###	FS500-699FA	CAJ 1### WJ 1###	FS100-299WA
Nonmetallic	CAJ 2###	FS500-699FB	CAJ 2### WJ 2###	FS100-299WB
Cables	CAJ 3###	FS500-699FD	CAJ 3### WJ 3###	FS100-299WD
Cable Trays	CAJ 4###	FS500-699FD	CAJ 4### WJ 4###	FS100-299WD
Insulated Metal	CAJ 5###	FS500-699FC	CAJ 5### WJ 5###	FS100-299WC
Bus Duct	CAJ 6###	FS500-699FE	CAJ 6### WJ 6###	FS100-299WE
Metal Ducts w/o Dampers	CAJ 7###	TBD	CAJ 7### WJ 7###	TBD
Mixed Multiple	CAJ 8###	TBD	CAJ 8### WJ 8###	TBD

Penetrant	Gypsum Wall		Wood Or Steel Framed Floor	
	UL	ITS	UL	ITS
Blank Openings	WL 0###	FS100-299WG	FC 0### FE 0###	FS100-299FG
Metallic	WL 1###	FS100-299WA	FC 1### FE 1###	FS100-299FA
Nonmetallic	WL 2###	FS100-299WB	FC 2### FE 2###	FS100-299FB
Cables	WL 3###	FS100-299WD	FC 3### FE 3###	FS100-299FD
Cable Trays	WL 4###	FS100-299WD	FC 4### FE 4###	FS100-299FD
Insulated Metal	WL 5###	FS100-299WC	FC 5### FE 5###	FS100-299FC
Bus Duct	WL 6###	FS100-299WE	FC 6### FE 6###	FS100-299FE
Metal Ducts w/o Dampers	WL 7###	TBD	FC 7### FE 7###	TBD
Mixed Multiple	WL 8###	TBD	FC 8### FE 8###	TBD



Fire Resistive Joints:

Joint Width	Floor to Floor	Wall to Wall
≤ 2"	FF-S/D*-0###	WW-S/D*-0###
> 2"; ≤ 6"	FF-S/D*-1###	WW-S/D*-1###
UL >6", ≤ 12"	FF-S/D*-2###	WW-S/D*-2###
>12", ≤ 24"	FF-S/D*-3###	WW-S/D*-3###
> 24"	FF-S/D*-4###	WW-S/D*-4###
ITS	CEJ###F	CEJ###W

Joint Width	Floor to Wall	Head of Wall
≤ 2"	FW-S/D*-0###	HW-S/D*-0###
> 2"; ≤ 6"	FW-S/D*-1###	HW-S/D*-1###
UL >6", ≤ 12"	FW-S/D*-2###	HW-S/D*-2###
>12", ≤ 24"	FW-S/D*-3###	HW-S/D*-3###
> 24"	FW-S/D*-4###	HW-S/D*-4###
ITS	CEJ###WF	CEJ###H

Joint Width	Perimeter Fire Barrier
≤ 2"	CW-S/D*-0###
> 2"; ≤ 6"	CW-S/D*-1###
UL >6", ≤ 12"	CW-S/D*-2###
>12", ≤ 24"	N/A
> 24"	N/A
ITS	CEJ###P

*S=Static / D=Dynamic



Building & Safety Codes:



International Building Code (IBC) 2012 Edition
107.2.2 Submittal Fire Shop Drawings
110.3.6 Fire & Smoke penetrations
202 Definitions Fire-Resistant Joint Through-Penetration Firestop System
705.5 Exterior Wall Fire-Resistance rating
705.9 Exterior Wall Joints
706.5 Fire Walls Horizontal continuity
706.6 Fire Walls Vertical continuity
706.9 Fire Wall Penetrations (see Section 714)
706.10 Fire Wall Joints (see Section 715)
707.5 Fire Barrier continuity
707.7 Fire Barrier Penetrations (see Section 714)
707.8 Fire Barrier Joints (see Section 715)
708.7 Fire Partitions Penetrations (see Section 714)
708.9 Fire Partitions Joints (see Section 715)
709.3 Smoke Barrier 1 Hour Fire-resistance rated
709.4 Smoke Barrier continuity
709.7 Smoke Barrier Penetrations (see Section 714)
709.8 Smoke Barrier Joints (see Section 715)
710.6 Smoke Partition Penetrations "approved material"
710.7 Smoke Partition Joints "approved material"
711.4 Horizontal Assemblies continuity
711.5 Horizontal Assemblies Penetrations (Section 714)
711.6 Horizontal Assemblies Joints (Section 715)
712.1.4 Vertical Assemblies Penetrations (Section 714)
712.1.11 Vertical Assemblies Joints (Section 715)
714 Penetrations
714.3.1.2 ASTM E-814 or UL1479
714.3.2 Membrane Penetrations
714.4.1.1.2 Through-Penetrations E-814 or UL1479
714.4.1.1.2 requires F&T In Floors
714.3.1.2 Wall Penetrations required F rating
715 Fire-Resistant Joint System
715.1.1 Curtain Wall Assembly (accordance with Section 715.4)
715.3 Test Criteria ASTM E-1966 or UL2079
715.4 Exterior Curtain Wall / Floor intersection
715.6 in Smoke Barriers air leakage <5 (UL 2079)

International Building Code (IBC) 2009 Edition
702 Definitions
712.2 Installation Details
712.3.1.2 Through Penetration Firestop
712.3.2 Membrane Penetrations
712.3.3 Ducts
712.3.4 Dissimilar material
712.4.1.1.2 Through Penetration Firestop
712.4.1.2 Membrane penetrations
712.4.1.3 Ducts
712.4.1.4 Dissimilar material
712.5 Smoke Barriers
714.1 Joints
714.2 Installation (Joints)
714.3 Fire Test (Joints)
714.4 Curtain Wall
714.5 Spandrel Wall
714.6 Joints (Smoke)

NFPA 101, "Life Safety Code"; 2009 Edition
8.3.5 Penetrations
8.3.5.1 Firestop Systems and Devices Required
8.3.5.1.3 Penetrations
8.3.5.1.4 Penetrations
8.3.5.2 Sleeves
8.3.5.3 Insulation and Coverings
8.3.5.5.1 Dissimilar Material
8.3.5.6.1 Membrane penetrations
8.3.5.6.2 Membrane penetrations
8.3.5.6.3 Outlet boxes
8.3.6 and 8.3.6.1 Joints
8.3.6.2 Joints and smoke
8.3.6.3 Joints and smoke
8.3.6.4 Representative joints
8.3.6.5 Joints and Test Standards
8.3.6.6 Joint and Test Standards
8.3.6.7 Curtain Walls and Perimeter Joints
8.3.6.7.2 Curtain Wall
8.4.4 and 8.4.4.1 Penetrations in smoke partitions
8.4.5 and 8.4.5.1 Joints and smoke partitions
A.8.3.5.1 Inspections – penetrations

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SIGNIFICANT CHANGES TO THE IPC/IMC/IFGC, 2012 EDITION #7202S12

Changes are identified then followed by in-depth discussion of how the change affects real world application. Photos, tables and illustrations further clarify application.



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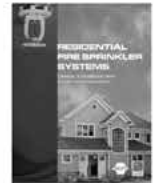
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About the International Code Council



The International Code Council is a member-focused association dedicated to helping the building safety community and construction industry provide safe, sustainable and affordable construction through the development of codes and standards used in the design, build and compliance process. Most U.S. communities and many global markets choose the International Codes. ICC Evaluation Service (ICC-ES), a subsidiary of the International Code Council, has been the industry leader in performing technical evaluations for code compliance fostering safe and sustainable design and construction.

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Washington, DC 20001-2070

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Birmingham, AL; Chicago, IL; Los Angeles, CA

1-888-422-7233
www.iccsafe.org



Does your jurisdiction apply IBC 2012 or later editions?

Special Inspection of firestopping is now mandated by the IBC!

1705.17 Fire-resistant penetrations and joints.

In high-rise buildings or in buildings assigned to Risk Category III or IV, special inspections for through-penetrations, membrane penetration firestops, fire-resistant joint systems and perimeter fire barrier systems that are tested and listed in accordance with Sections 714.3.1.2, 714.4.2, 715.3 and 715.4 shall be in accordance with Section 1705.17.1 or 1705.17.2.

1705.17.1 Penetration firestops. Inspections of penetration Firestop systems that are tested and listed in accordance with Sections 714.3.1.2 and 714.4.2 shall be conducted by an approved agency in accordance with ASTM E 2174.

1705.17.2 Fire-resistant joint systems. Inspection of fire-resistant joint systems that are tested and listed in accordance with Sections 715.3 and 715.4 shall be conducted by an approved agency in accordance with ASTM E 2393.

AHJs should be asking for the firestop special inspection report for all applicable buildings.

Training available from IFC for firestop special inspectors

Online course on firestop special inspection

The IFC provides a free online self-paced study course for those wishing to competently conduct special inspections in accordance with ASTM standards E2174 and E2393, as mandated by the IBC.

Go to www.firestop.org/inspections for details.

The course includes an available 2-hr proctored online exam, with an IFC certificate provided to all those passing with a grade of 80% or better.

IFC-certificated special inspectors are listed at:
www.firestop.org/certificate-holders.

IFC Membership List

For a full list of firestop manufacturers, 3rd party firestop inspectors including non-voting members such as firestop contractors, code officials, architects, engineers, and related associations, check the IFC website at:

www.firestop.org



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