Fire Stopping Service Penetrations In Buildings

2003 Version 1.0

Explanatory material to the
Alberta Building Code 1997

Part 3 - 3.1.9

Part 9 - 9.10.9.6 and 9.10.9.7

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Fire Stopping Service Penetrations In Buildings

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Preface

This publication is intended to assist designers, builders, suppliers and code officials in understanding the requirements for fire stopping penetrations through fire separations in buildings. The guide primarily addresses issues in multi-family residential construction, but the concepts apply to any type of building, other than single-family and two-family dwellings, and townhouses where no services pass through from one unit to another.

In Alberta over the last number of years there have been:

- Changes in codes to allow larger multi-family buildings to be constructed using wood framing.
- Advances in fire stopping systems.
- Advances and new materials available for all aspects of construction.
- Increased number of larger wood-frame, multi-family projects being constructed.
- Single-family homebuilders moving into the realm of multi-family home construction without full knowledge of the differences between single and multi-family construction.

With all these changes, designers, builders, developers and building officials have all struggled with the increased complexity and variety of materials and construction systems proposed. The challenges have been the greatest in apartment style multi-family, wood-frame buildings, which have a large number of fire separations.

This guide is intended to help all involved gain a better understanding of the requirements, understand some of the options available and make informed choices about how to select appropriate systems for buildings. It was created by a committee of builders, designers, contractors and building officials and outlines examples of typical solutions proposed by this industry group. We acknowledge that there may be methods other than those shown in the guide for achieving compliance.

Acknowledgements

We wish to acknowledge the organizations that contributed to this edition of ***Fire Stopping Service Penetrations in Buildings***.

The following companies or corporations provided representatives to serve on the committee of designers, builders, suppliers and code officials who met to agree on the content and structure of this document. These representatives also served as reviewers to ensure the document was accurate and useful to all groups. The companies and corporations who participated are:

Gibbs Gage Architects
Hilti Canada Ltd
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Janl Developments
LEW Engineering Ltd
Performer Electric
Poon McKenzie Architects
The City of Calgary

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PART 1
BASIC CONCEPTS

Overview - Fire Protection Systems in Buildings

Buildings are constructed using the *Alberta Building Code* and other design documents. To ensure buildings are safe for people to use, building codes use a number of methods to provide for fire protection of the building in times of an emergency.

Many elements combine together to provide fire protection in a building. Some of the major systems are:

Construction
Is the building constructed of combustible or noncombustible materials?

Firewalls
May be provided to divide a building into a number of smaller buildings.

Fire Separations
May be provided:
- At floors levels,
- Between suites,
- Between suites and public corridors,
- At roof/ceiling level,
- Around exit stairs,
- Around service and elevator shafts,
- Around other rooms requiring protection,
- At exterior walls for spatial separation purposes and to support the structural system of the building

Fire Stopping
Using cast-in-place construction or fire stop systems to seal openings where they pass through fire separations.

Concealed Space Barrier
Barriers, built in concealed spaces and at floor levels. Please see the definition on page 4.

Fire Alarm, Detection and Suppression Systems
Fire alarm, detection and sprinkler systems.

When a fire emergency occurs in a building, the major concerns are:

- Evacuating the occupants before they are overcome by toxic smoke and fumes, and
- Containing the fire in one area, to prevent the spread of fire to the remainder of the building.

These goals are realized by constructing and installing good fire protection measures into a building of which fire stopping is a key component.

Definitions

We use certain terms when talking about fire separations and fire stopping. The most important of these terms are defined below.

Alberta Building Code

Closure
Means a device or assembly for closing an opening through a *fire separation* or an exterior wall, such as a door, a shutter, wired glass or glass block, and includes all components such as hardware, closing devices, frames and anchors.

Fire-protection rating
Means the time in minutes or hours that a *closure* will withstand the passage of flame when exposed to fire under specified conditions of test and performance criteria, or as otherwise prescribed in this Code.

Fire-resistance rating
Means the time in hours or fraction thereof that a material or assembly of materials will withstand the passage of flame and the transmission of heat when exposed to fire under specified conditions of test and performance criteria, or as determined by extension or interpretation of information derived therefrom as prescribed in this Code.

Fire separation
Means a construction assembly that acts as a barrier against the spread of fire (see also Appendix A of the Alberta Building Code).

Flame-spread rating
Means an index or classification indicating the extent of spread-of-flame on the surface of a material or an assembly of materials as determined in a standard fire test as prescribed in this Code.

Other Terms

Concealed Space Barrier
Barriers built to contain the spread of fire by breaking large concealed spaces into smaller spaces. During construction, concealed spaces or areas are created that allow fire to spread rapidly without being detected (e.g., attics, crawl spaces, wall cavities in balloon framing. See Subsections 3.1.11 and 9.10.15 .

Fire Stop
A system to seal around building services to prevent the passage of smoke and flames for a period of time, as tested in a laboratory. Fire stop systems are tested based on the requirements of CAN4-S115-M, "Standard Method of Fire Tests for Firestop Systems".

F Rating
A fire stop system that remains in the opening during the fire test for the rating period (i.e.: ¾ hour, 1 hour, etc.), without permitting the passage of flame through the opening or any flaming on any element on the unexposed side of the fire stop system. F ratings may be at the level of a fire-protection rating or fire-resistance rating, depending on the type of service penetration is being protected.

FT Rating
A fire stop system that remains in the opening during the fire test, without permitting the passage of flame through the opening or any flaming on any element on the unexposed side of the fire stop system. It also limits the raised temperature on the unexposed surface to less than 181°C above ambient room temperature.

Classifying a Building

When a designer begins to initially plan a building, early decisions to be made include:

- How to classify the building (Part 3 or Part 9),
- Whether to build using combustible or noncombustible construction, and
- Whether the building requires sprinklers.

The *Alberta Building Code* classifies most buildings into one of two parts of the code.

Part 9

Includes buildings and controls construction based on:

- Occupancy type - residential, office, retail or medium or low hazard industrial (Groups C, D, E, F2, or F3),
- Building height - 3 storeys or less,
- Building area - maximum 600 m^2, and
- Type of construction - combustible or noncombustible. (Noncombustible is not required in Part 9 buildings, but may be used.)

Part 3

Includes buildings and controls the construction based on:

- Occupancy type - assembly, institutional, residential, office, retail or industrial (Groups A, B, C, D, E, or F),
- Building height,
- Building area,
- Type of construction - combustible or noncombustible, and
- Sprinklered or unsprinklered.

Once the building is classified as either a Part 3 or Part 9 building, then you can determine the fire-resistance ratings required for fire separations or assemblies. The fire-resistance rating is the length of time, in minutes or hours, the fire separation or assembly would last in a laboratory fire test situation.

HOT TIP

Code Revisions to Allow More Wood-Frame Construction

Part 3 allows a multi-family building of wood-frame construction that is up to 4 storeys in building height provided it meets the area requirements outlined in the classification article.

The code also allows you to subdivide a building into a number of Part 3 or Part 9 buildings, using masonry or concrete firewalls.

HOT TIP

Combustible or Noncombustible Construction?

Although the Alberta Building Code describes construction of two types, combustible and noncombustible, noncombustible construction does allow limited combustible elements to be used in buildings.

Fire Separations

What is a Fire Separation?

In the *Alberta Building Code* fire separation is defined as follows.

> *Fire separation* means a construction assembly that acts as a barrier against the spread of fire.

A fire separation is a wall or floor assembly that has a fire-resistance rating of a particular length of time (e.g., ¾ hour, 1 hour, 2 hour). It acts as a continuous barrier to the passage of flame and gases and will stand up to a fire department hose stream. The key concept to remember is "continuous", so any penetrations in the fire separation need to be properly fire stopped to ensure the integrity of the fire separation.

To paraphrase from *Standard Methods of Fire Endurance Tests of Building Construction and Materials (CAN/ULC-S101-M)*, the wall or partition needs to sustain the fire endurance test without the passage of flame or hot gases.

Products of a typical fire include flames, smoke, heat, and toxic gases, all of which affect the safety of the occupants of the building. The building code recognizes that these products of combustion need to be limited or contained for a number of reasons.

- Flame and heat help create a larger fire.
- Smoke and toxic gases are the main contributors to death in fires.
- Smoke reduces visibility and causes disorientation, affecting people's ability to escape from a building.

Fire separations are one means of containing or limiting the spread of fire and the undesirable products of combustion.

Designing a Fire Separation

There are three methods that can be used to design an assembly.

1. Using a standard assembly tested by an approved testing agency. The assemblies are tested using *Standard Methods of Fire Endurance Tests of Building Construction and Materials (CAN/ULC-S101-M)*. Agencies which test assemblies include Underwriters Laboratories of Canada (ULC) and Intertek Testing Services (Warnock Hersey).

2. Using a built-up assembly of materials outlined in Appendix D of the *Alberta Building Code*. Assemblies created in this way may only be rated for a maximum of 90 minutes.

3. In a Part 9 building, using the wall, floor, ceiling and roof assemblies in Tables 9.10.3.1.A and B.

Example - Fire Separations in Multi-Family Buildings

In a multi-family wood-frame building typical assemblies are usually as shown in the table and Figure 1.

Assembly	Fire-Resistance Rating - Hours
Between Parkade and Main Floor	1½ - 2
Floors	¾ - 1
Public Corridors	¾ - 1
Exit Stairs Parkades Residential Floors	 1½ - 2 ¾ - 1
Shafts	¾ - 1
Service Rooms	1

1

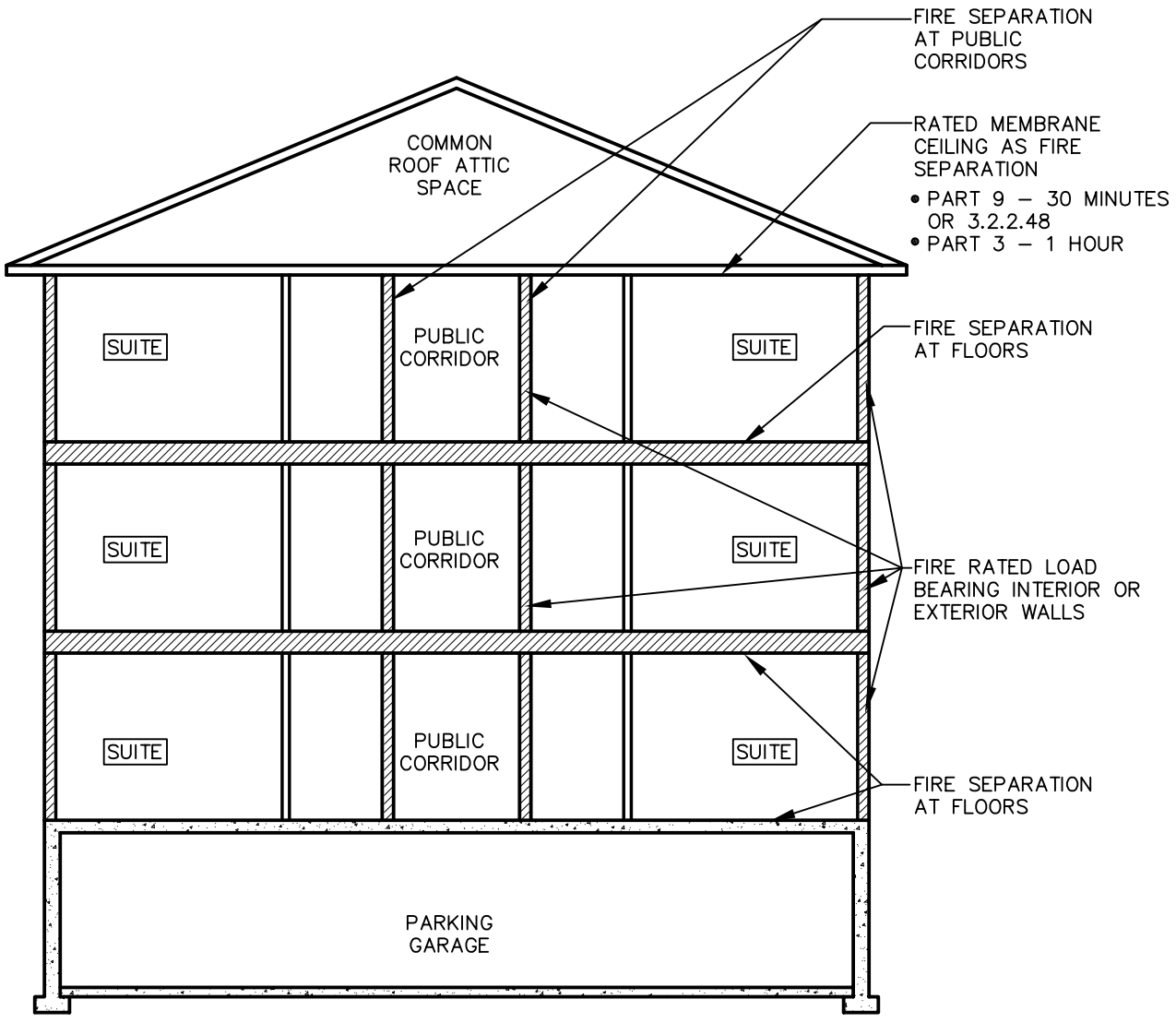

Illustration of Fire Separations/Fire Resistance Ratings in a Typical Building

Typical Fire Separation Components

Fire separations consist of an entire assembly. In wood-frame construction this means there are a number of components which combine together to form the separation.

A typical floor may consist of:

Floor:
- Finish floor
- Topping (optional)
- Sub floor
- Screws or nails
- Joists and beams (conventional or manufactured)
- Insulation (if required by sound transmission classification (STC) design)
- Resilient channel (if required by STC design)
- Type X gypsum board

Walls:
- Type X gypsum board
- Studs
- Screws or nails
- Insulation (if required by STC design)
- Resilient channel (if required by STC design)
- Type X gypsum board

See the illustrations of a typical floor assembly (Figure 2), corridor wall (Figure 3), and double-stud wall fire separation (Figure 4), often used to divide residential units. Note that the illustration of the double-stud wall fire separation also shows the following elements which may be used to accommodate pipes, ducts, and wires:

- furred out walls on either side of the fire separation; and
- dropped ceiling below the rated floor fire separation.

Because we are not aware of fire stop testing for services in double-stud wall fire separations containing a 25 mm air space, services may need to be placed in other walls, service spaces or shafts. Additionally, double-stud wall fire separations are also often used as load bearing walls. Placing large pipes and ducts in these walls often destroys the structural integrity of the walls. Limiting the number of penetrations will also improve the integrity of the fire separation.

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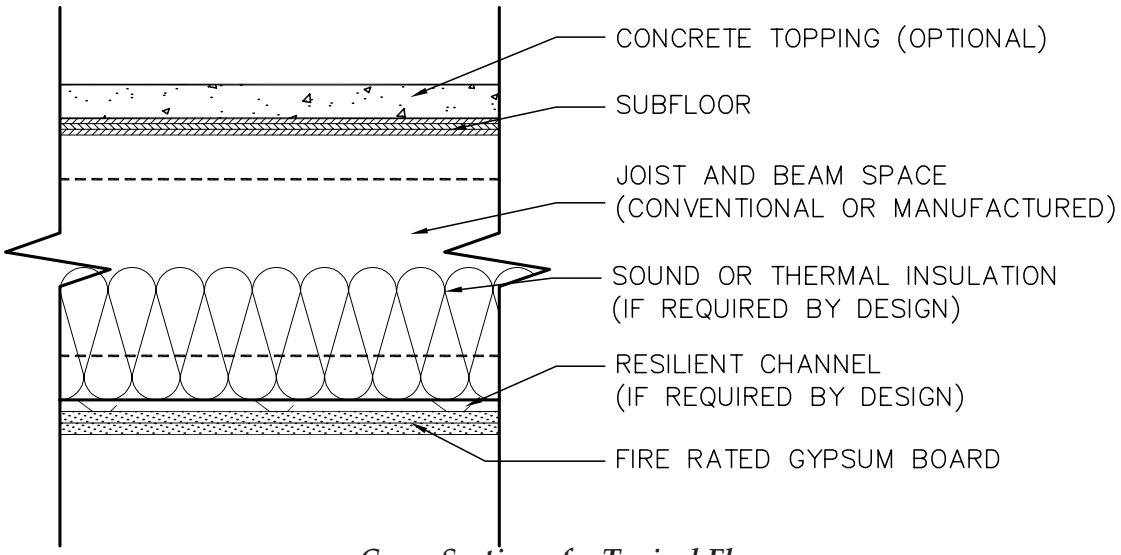
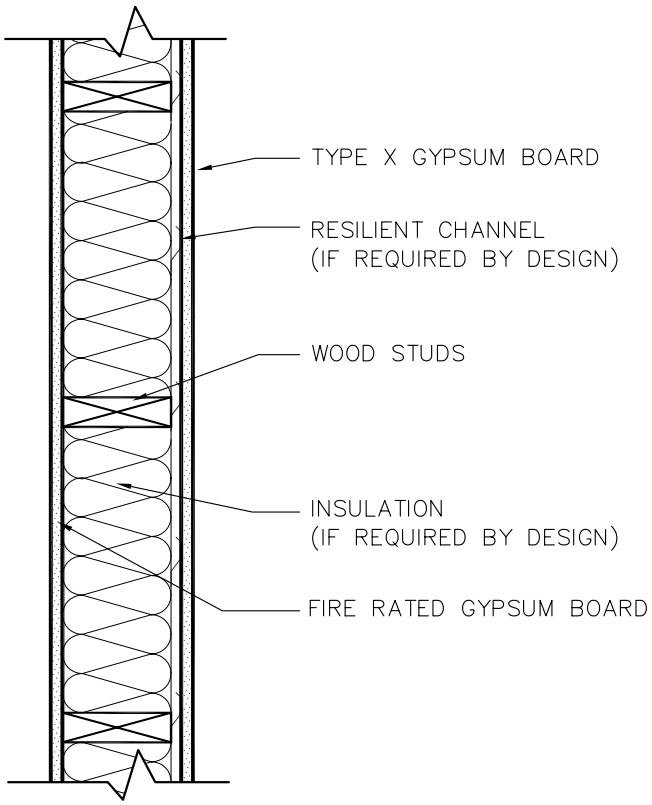


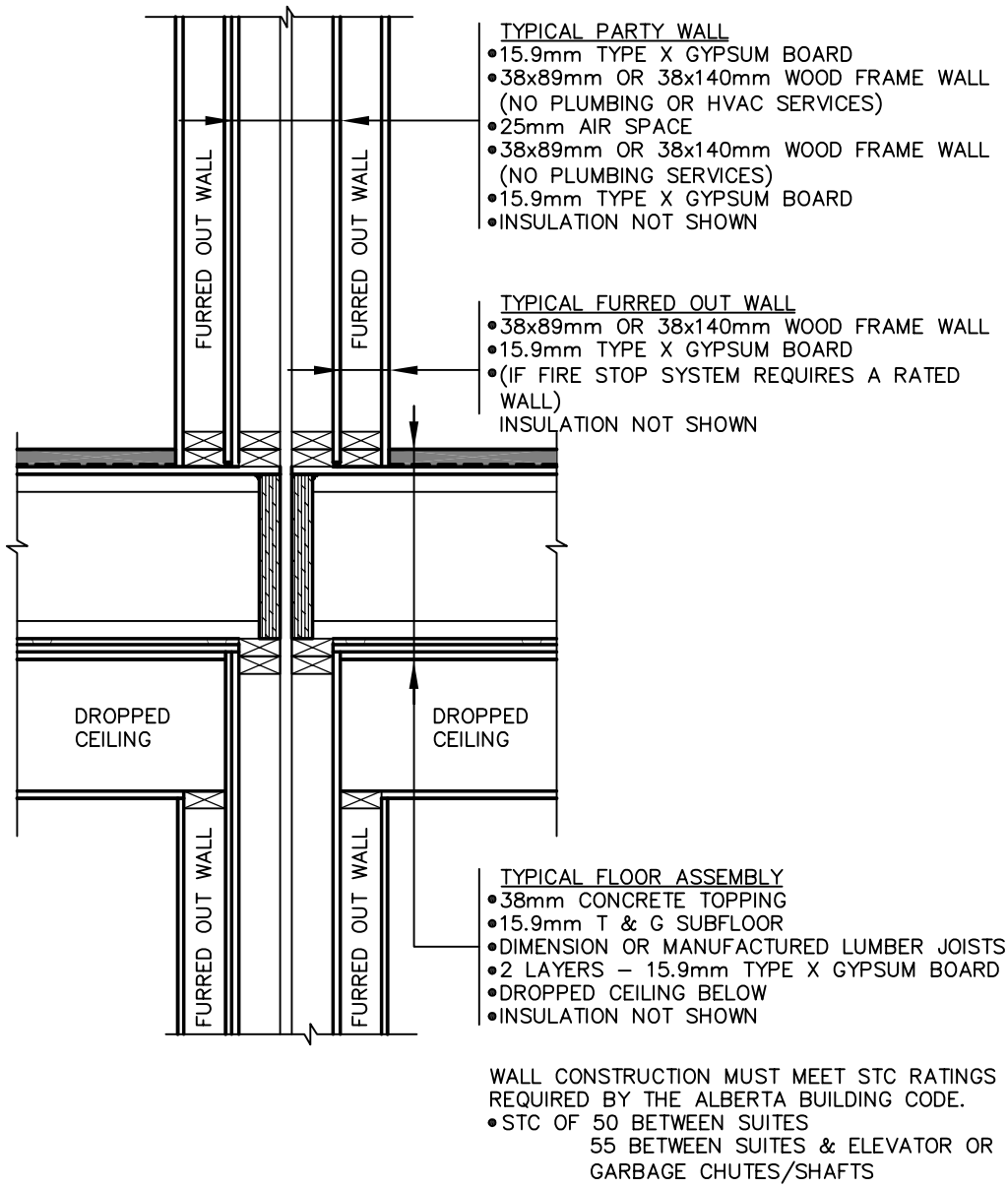
Cross Section of a Typical Floor

3



Plan View of a Corridor Wall

4



Typical Double-Stud Wall Fire Separation and Floor Assembly

Penetrations Through a Fire Separation

Fire separations must be continuous. Where there are penetrations of fire separation elements, such as plumbing for toilets, other piping, ducts and electrical wiring, these penetrations must be adequately fire stopped (Subsection 3.1.9. and Articles 9.10.9.6. and 9.10.9.7.).

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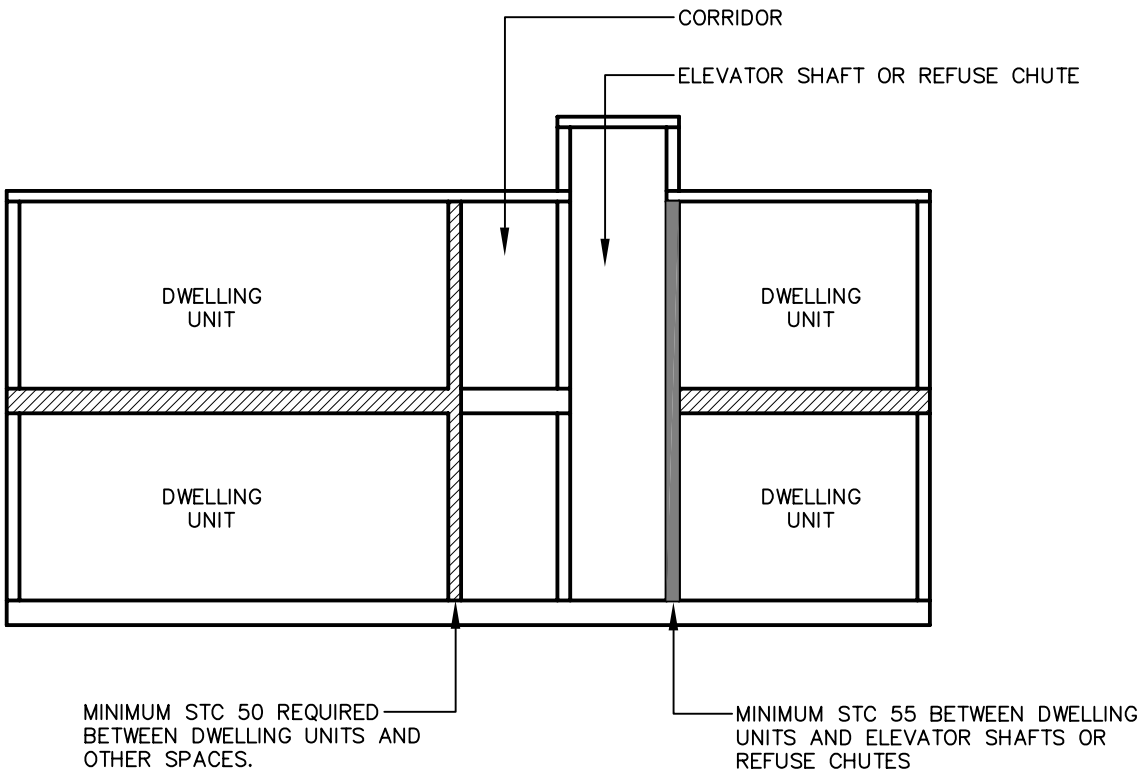


STC Ratings Required Between Suites and Other Spaces in Buildings

Sound Transmission Class (STC) Ratings

In trying to clarify fire stopping requirements, other related issues were raised. One of these is the requirement for sound transmission class (STC) ratings in residential buildings. Although this document does not deal specifically with STC ratings, the issues of fire stopping and STC ratings are often inter-related.

For example, we know that the more openings we make into an assembly requiring an STC rating, the lower the STC rating will be. Yet, there does not appear to be a specific exclusion from installing services in assemblies requiring an STC rating.

Walls and floors with an STC ratings of:

- 50 are needed to separate residential suites from every other space in a building. (Sentences 3.3.4.6.(2) and 9.11.2.1.(1)).
- 55 are needed to separate residential suites from adjacent elevator shafts and refuse chutes. (Sentences 3.3.4.6.(3), and 9.11.2.1.(2)).

The three most common situations requiring STC ratings are:

- Party walls between residential suites. These are usually double-stud wall fire separations containing a 25 mm air space.
- Public corridor walls between the corridor and residential suites. These are usually single-stud walls with offset studs on a larger plate.
- Floor assemblies between residential suites.

We believe the effect of putting large diameter pipes or ducts into walls or floors, thus reducing, compacting, or eliminating the batt insulation will lower the original "tested" STC rating for the wall or floor. Additionally, the holes required to allow services out through the wall or floor also diminish STC ratings. In addition to the concerns with fire stopping, designers also need to consider STC ratings when deciding where to locate heating ducts, water distribution, gas and plumbing pipes.

For vertically installed pipes and ducts, locate services in:
- Furred out walls in front of double-stud wall fire separations;
- Other interior walls; or
- Service spaces.

For horizontally installed pipes and ducts:
- Keep services for the unit above within the rated floor assembly. Where possible, provide a false ceiling for services in the unit below.

If designers do want to put services in STC rated walls, the authority may ask for:
- An STC test to show that the wall assembly containing the services and service penetrations does meet the required STC rating.
- Fire stop tests for the services for that particular type of wall assembly.
  Note that we have been unable to find any fire stop tests for double-stud wall fire separation containing a 25 mm air space.

HOT TIP

Sound Transmission Class (STC) Ratings
An STC rating is obtained by testing a floor or wall assembly for the transmission of sound.

Many factors influence how much sound passes through an assembly. These include but are not limited to:

- Leaks at wall-to-wall or wall-to-floor joints;
- Leaks around openings into walls or floors for equipment or services;
- How rigidly the building components are connected together; and
- The mass of the floor or wall assembly.

Achieving good STC ratings is often in conflict with installing various building services.

Consult acoustical design professionals for more information on this topic.

Organizations who have done more research into STC ratings include:
- Canada Mortgage and Housing www.cmhc.ca
- National Research Council / Institute of Research in Construction www.nrc.ca/irc

Please visit their websites to learn more.

Fire Stopping

General Information

The requirement of a seal to prevent the passage of smoke, flame and toxic gases comes from the following code and standard references.

- The *Alberta Building Code* requires all fire separations be constructed as continuous elements (Articles 3.1.8.1. and 9.10.9.2.).
- The *Alberta Building Code* (Appendix A) notes that all fire separations, even those without a fire-resistance rating act as barrier to the spread of smoke and fire.
- Fire separations requiring a fire-resistance rating are tested in accordance with, *Standard Methods of Fire Endurance Tests of Building Construction and Materials (CAN/ULC-S101-M)*, which states the wall or partition needs to sustain the fire endurance test without the passage of flame or hot gases.
- The code requires that service penetrations through membranes that form part of a fire separation be fire stopped (Subsection 3.1.9. and Articles 9.10.9.6. and 9.10.9.7.).
- Fire stop systems are tested using, *Standard Method of Fire Tests of Fire Stop Systems (ULC-S115-M)*. This standard refers back to the CAN/ULC-S101-M and states that the assembly needs to "have withstood the test without the passage of flame or hot gases".

These references together identify that the fire separation construction and any penetrations through it must prevent smoke and hot gases from passing through the fire separation.

Why Have the Codes Identified Fire Stopping as Important?

Here are a few reasons why everyone needs to pay more attention to fire stopping.

- Fire statistics indicate that 67% of fire deaths are due to smoke and gases.
- Over 44% of such deaths occur in other than the room of fire origin.
- Visibility is impaired - 47% of survivors caught in a fire could not see more than 12 feet within the first 90 seconds.
- Smoke travels at 50-300 feet per minute.

HOT TIP

A Bit of History

On November 21, 1980 the MGM Grand Hotel experienced a fire on the first floor of the hotel. Smoke and gases from the fire found its way to higher floors through seismic gaps, plumbing and electrical openings. A total of 67 victims were found on the 16th or higher floors. The fire never spread beyond the main floor.

Two Types of Fire Stopping - What is the Difference?

In the *Alberta Building Code*, the term fire stop is actually used for two different concepts.

Building Services (Fire Stops)

When building services such as plumbing pipes, mechanical ducts/chimneys, electrical and communication wires are installed in a building, some of them pass through fire separations or membranes forming part of a fire separation. To ensure the fire separation performs as intended, it is necessary to seal around all penetrations with a fire stop system to restrict the spread of flame and hot gases through the openings created by installing the building services. This is covered by Subsection 3.1.9., Articles 9.10.9.6. and 9.10.9.7.

Concealed Spaces (Concealed Space Barriers)

During construction, certain spaces or areas are created that allow fire to spread rapidly without being detected. These concealed spaces consist of roof spaces, crawl spaces, eave overhangs and wall cavities in balloon framing, etc. Barriers are constructed within these areas to limit the size of these spaces and restrict the spread of fire. Requirements for this type of fire stopping are covered by Subsections 3.1.11. and 9.10.15. We will call this type of fire stop, a concealed space barrier, to help clarify the two concepts.

THE TOPIC WE ARE INTERESTED IN THIS DOCUMENT IS FIRE STOPPING AT PENETRATIONS OF BUILDING SERVICES.

Methods of Fire Stopping

In the fire stopping sections of the code, two options are given for sealing around building services (Articles 3.1.9.1. and 9.10.9.6.). Either the opening around the piping, wiring or other service must be:

- Tightly fitted, or
- Sealed with a fire stop system tested using, *Standard Method of Fire Tests of Fire Stop Systems (ULC-S115-M)*. The fire stop needs to have acceptable F and FT ratings depending on where it is used.

HOT TIP

What Does Tightly Fitted Mean?

Consultation with code writers at the national level revealed that they interpret "tightly fitted" to mean cast-in-place or grouted-in-place (for metal pipes only). If this type of fire stopping is not used, then a fire stop system is required. Normally cast-in-place or grouted-in place would only apply to where a concrete floor or wall is being penetrated. Provision for expansion and contraction of the building service needs to be accommodated so that the seal around the service is not broken by movement when the fire stop is cast or grouted in place.

Fire Stop Systems

What is a Fire Stop System?

A fire stop system is a tested system that is made up of a number of components that act together to prevent the passage of hot gases and flame through a fire separation. For walls, identical fire stop systems are applied to each side of the wall. For floors, the fire stop system is applied below or within the opening through the floor.

To select a fire stop system, there are two things you need to know:

- Type of penetrating pipe, wire, duct or cable, and
- Construction of the wall, floor/ceiling or membrane through which the service is penetrating.

When you have determined these two items you can select a system that has been tested for use with the type of penetrating item and type of assembly you have.

The components typically include some of the following items:

- **Size of annular space (opening around a pipe, wire, etc.)**
  When an intumescent (expandable) type of fire stopping is used it is important that the annular opening be large enough to apply a sufficient amount of caulking that it will expand to fill the entire annular space and seal off the end of the combustible pipe should it burn off. When the annular space is not large enough, the amount of caulking is not sufficient and the opening will not completely seal under fire conditions. This means flame and hot gases will pass through the opening.

- **Backing material**
  Use an acceptable type and install to the depth required to allow an adequate amount of caulking in the annular space and to prevent the caulking from falling through or into a cavity behind a membrane penetration. Usually mineral wool or a foam-backing rod is used to keep the fire stop material in place until it sets or cures.

- **The fire stop product(s) used in the assembly (tested to CAN4-S115-M standard).**
  These could include one or more of the following:

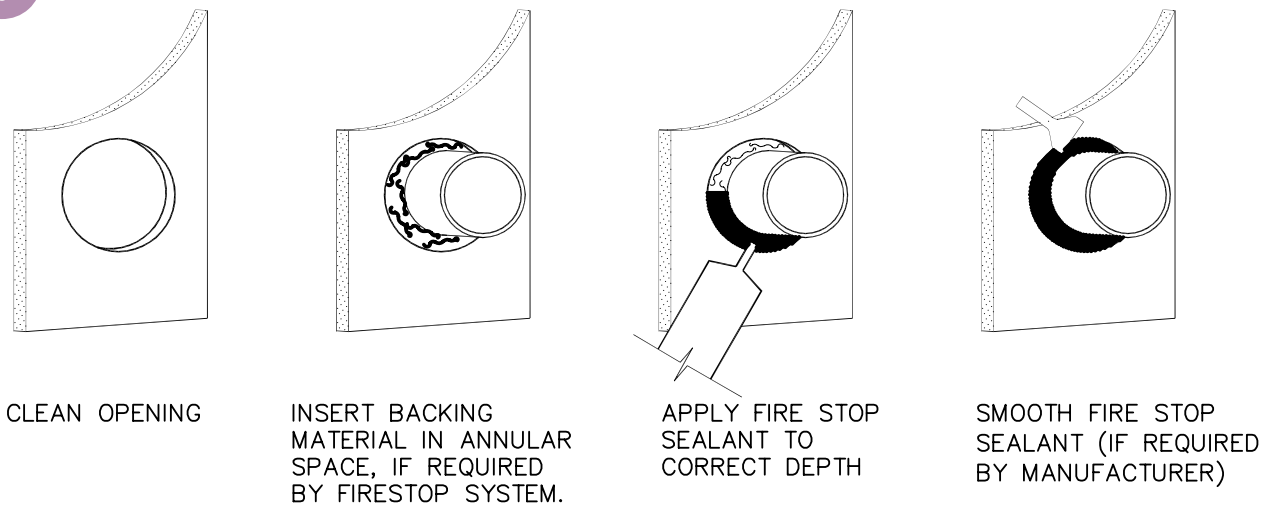
  - Sealant
    ~ Intumescent (expands when exposed to flame and heat)
    ~ Elastomeric (silicone based)
    ~ Flexible (acrylic based)
    Select for either combustible or noncombustible pipes or cables that penetrate the fire separation. The intumescent type is generally used for combustible pipe penetrations while the other types are generally used for noncombustible pipe or cables.
  - Fire stop collars
    ~ Prefabricated
    ~ Assembled on-site
  - Fire stop sleeve
  - Flexible block
  - Pillows
  - Fire stop putty
  - Flexible wrap strip
  - Joint spray
  - Trowelable fire stop compounds

Many fire stop products are intumescent meaning the material will expand and grow when exposed to flame and heat. New products are created on a regular basis, so the above may not list every possible type of device.

For an example of how to install a typical fire stop system see Figure 6.

Follow the specific installation instructions for the fire stop system you choose.

6



Typical Installation of a Fire Stopping System Around Pipes

Compatibility of Fire Stop Sealants with Pipes and Wires

Fire stop system manufacturers test fire stop sealants and other components in combination with specific types of pipe or wire and through specific types of assemblies. The sealants may not be compatible with every type of pipe material or wire jacket they come in contact with.

Ensure you use a tested design or if you do not require a tested design, check with the manufacturer to ensure the compatibility of the fire stop sealant with the type of pipe material or wire jacket with which it comes in contact.

Combustible or Noncombustible Services

In the past, building codes required building services be noncombustible and the code still contains articles suggesting that generally services are noncombustible (Articles 3.1.9.2 and Sentence 9.10.9.7.(2)). Through exception articles, combustible services may be allowed in limited cases without testing, as well as more extensively based on the tests by manufacturers. An additional factor that needs to be kept in mind is whether the services also meet the following requirements:

- Flame spread rating (25) in return air plenums and Part 3 noncombustible buildings.
- Smoke developed classification (50) in return air plenums and high buildings. (Subsection 3.2.6.)

Many combustible pipes do not meet these requirements which makes it difficult to use them in buildings where they are located outside of wall assemblies or concrete floor slabs. (Articles 3.1.5.15. and 3.6.4.3.)

Fire Stop Ratings

Although fire stops are tested for a number of criteria, under the *Alberta Building Code*, fire stops may require any one of the three following ratings:

- **F rating - Most Services**
  The minimum rating required for all fire stops. The F rating required is the same as a closure, which is one level below the fire-resistance rating required for the fire separation
- **F rating - Combustible Drain, Waste and Vent Pipe**
  Required for all fire stops involving combustible drain, waste and vent pipe. The F rating required is the same as the fire-resistance rating for the fire separation. The pipe must also meet a pressure differential of 50 Pa on the fire exposed side during the test. This pressure simulates the pressures that occur during a fire condition.
- **FT rating - Floor/Ceiling (Article 3.2.1.2) and Firewalls**
  Required for all fire stops in horizontal fire separations above storage garages classified as separate buildings and firewalls. The FT rating is the same as the fire-resistance rating for the fire separation. The test also requires the fire stop to limit the rise in temperature on the unexposed surface to less than 181°C above ambient room temperature. This temperature rise component makes obtaining an FT rating more difficult.

  Cast iron pipes, steel pipes, copper pipes and electrical wiring may need fire stop systems that require these pipes or wires to be insulated. Another choice is to protect pipes and wires in a shaft. The number and type of fire stop systems available to meet FT ratings is limited.

See the chart that follows for the required F and FT rating for fire stops.

Fire stop systems are tested by approved laboratories such as:

- **Underwriters Laboratories of Canada (ULC)**
  ULC prefixes:
  SP Service penetrations
  SPC Service penetrations for combustible systems (drain, waste and vent piping)

  For combustible drain, waste, and vent pipe, you need to read the top of the listing to determine if the pipe was tested for a 50 Pa pressure differential.

- **Warnock Hersey (WH) through Intertek Testing Services (ITS)**
  Warnock Hersey prefixes:
  PH Penetrating horizontal (floor) assemblies
  PHV Penetrating horizontal or vertical assemblies
  PV Penetrating vertical (wall) assemblies

  For combustible drain, waste and vent pipe, you need to read the top of the listing to determine if the pipe was tested for a 50 Pa pressure differential.

HOT TIP

Can I Use Listings for Combustible DWV Pipe From Underwriters Laboratories (cUL)?

Use caution here and check with your local code official and UL. Tests done by UL (the American counterpart of ULC) for combustible DWV pipe may only be used for "closed" water distribution systems. Combustible drain, waste and vent piping has not been tested for the additional 50 Pa pressure differential required in Canada and, therefore, does not pass the test for use in Canada.

Manufacturers literature often shows a cUL mark. This mark allows specific use of the pipe for a "closed" system and is not an approval for use as drain, waste, vent pipe or an "open" system.

In addition, tests done by UL for closed water distribution systems only, are not valid for use in Canada.

Common cUL prefixes are:

CAJ	FC
FA	WL

Be aware of the limitations on the use of combustible pipe fire stop systems bearing the cUL mark.

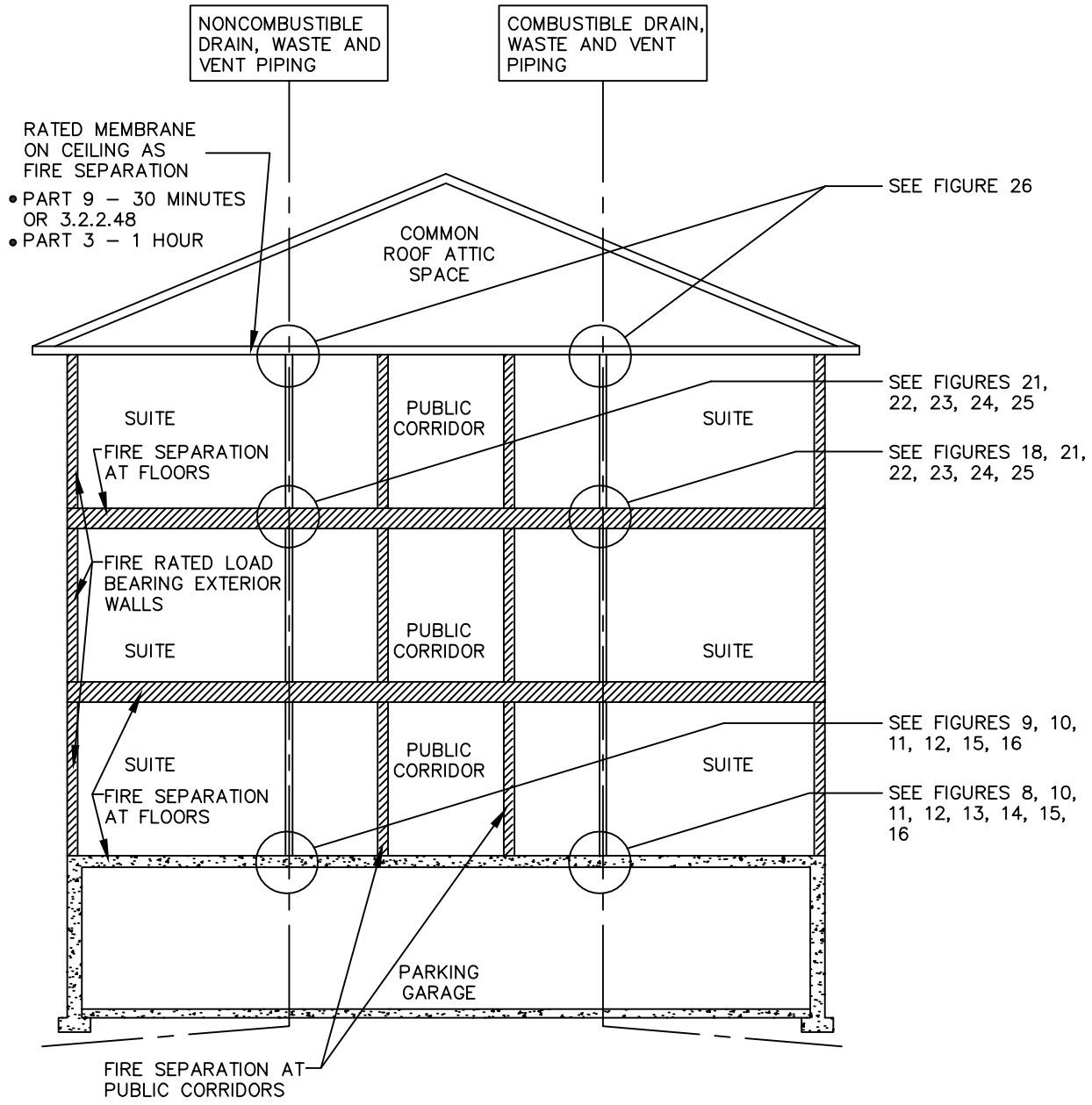
Fire Separation	Fire Stop		
Fire-Resistance Rating	**F Rating Most Services**	**F Rating Combustible DWV (Pressure - 50 Pa)**	**FT Rating Floor/Ceiling (Article 3.2.1.2) Firewall**
45 minutes	20 minutes (Part 9) 45 minutes (Part 3)	45 minutes	
1 hour	45 minutes	1 hour	
1.5 hours	1 hour	1.5 hours	
2 hour	1.5 hours	2 hours	2 hours

PART 2
FIRE STOPPING IN COMBUSTIBLE BUILDINGS

Part 2 - Fire Stopping in Combustible Buildings

PART 2A
PIPE PENETRATIONS

7



Typical Building Showing a Combusible or Noncombustible Piping System

Overview

Opposite is an illustration of a building showing either a completely combustible or a completely noncombustible piping system (Figure 7). Normally, if you start with a combustible system, you remain with a combustible system. The same thing applies to a noncombustible system. There are four exceptions to this that we will cover later. They are:

- Combustible piping allowed in one storey, one fire compartment garages (see page 26);
- Combustible drain piping allowed through a concrete floor slab provided it leads directly from a noncombustible water closet (see page 27);
- Alternating fire compartments in combustible and noncombustible pipe (see page 44); and
- Noncombustible pipe risers changing to combustible pipe outside of the shaft or wall membrane (see page 45).

Generally speaking, fire stop systems around noncombustible pipes incorporate compacted mineral wool and a caulk, while fire stop systems around combustible pipes may involve compacted mineral wool, caulk and other fire stop components such as collars, intumescent wraps, etc. See the general information about fire stop systems beginning on page 15. Each system is individual and must be used as specified by the manufacturer.

HOT TIP

Piping in Shafts

Only noncombustible piping is allowed in continuous vertical shafts. Combustible pipe may be used within wall assemblies or service spaces where a tested fire stop system is provided at each floor level.

HOT TIP

Abandoned Openings

Sometimes a hole is cut in error and pipe, wire or mechanical equipment is not installed through the opening. When this occurs, close the opening using the same type of fire-resistive construction used to construct the original fire separation. Alternatively, a fire stop system tested for this purpose could be used to seal the opening.

Garages

General Information

Garages may be single or multi-storey structures. In multi-storey garages although the *Alberta Building Code* allows ramps, the floors are still considered fire separations and this requires that penetrations through the floors be fire stopped.

The most critical item to be considered when pipes pass through the floor slab above the garage, is whether fire stop system around the piping passing through the slab requires an F rating or an FT rating. This is dependant on whether the garage is part of the same building or a separate building from the building above it. The F and FT ratings required are outlined below.

Garage Classification	Fire Stop		
Fire Separation Fire-Resistance Rating	**F Rating** Most Services	**F Rating** Combustible DWV (Pressure - 50 Pa)	**FT Rating** Floor/ Ceiling (Article 3.2.1.2.) Firewalls
Same Building			
1 ½ hour	1 hour	1 ½ hour	not applicable
Separate Building			
2 hour	not applicable	not applicable	2 hour

If the garage is a separate building, it means that an FT rating is required. FT ratings are significantly more difficult to achieve and less designs are available to choose from.

HOT TIP

Classifying a Garage as a Separate Building - FT Rating Required

Many designers choose to classify the garage as a separate building from the structure above it using Sentence 3.2.1.2., particularly when designing multi-family buildings. There are a number of reasons for making this choice. Two major reasons are:

- The ability to place a number of smaller buildings over a larger garage.

  If you classify the garage separately, you can often place a number of buildings over the top of a common garage area, without having to use the large garage area to classify the entire building.

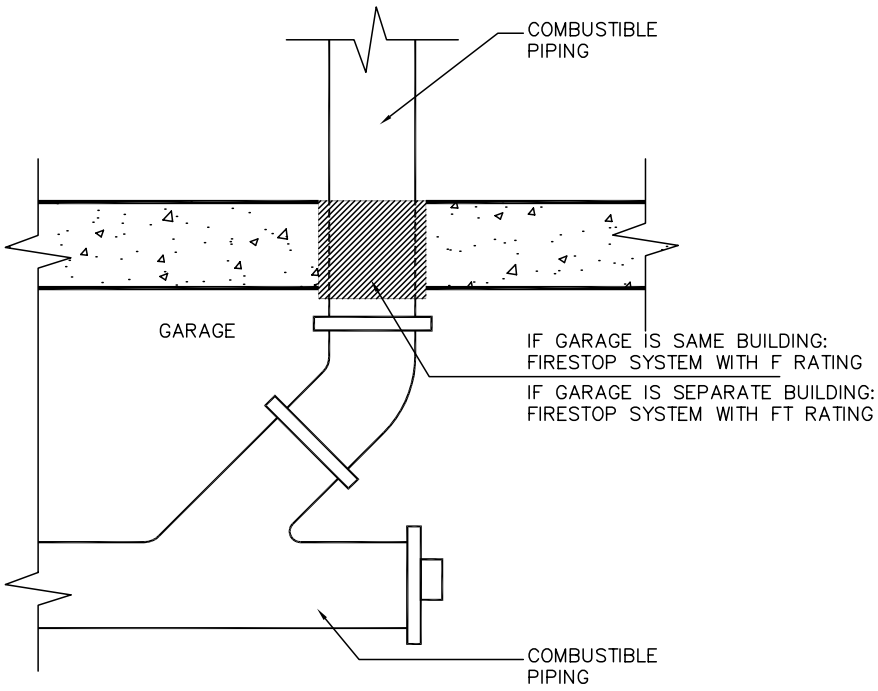
- The use of different NFPA codes for the design of the sprinkler system in the garage and a multi-family building above.

  By classifying the garage as a separate building, designers are also allowed to use NFPA 13 to design the sprinkler system in the garage portion, while the less restrictive NFPA 13R may be used to design the building above, if it is residential.

Examples of how the pipe would appear where passing through the garage floor follow in Figures 8, 9 and 10.

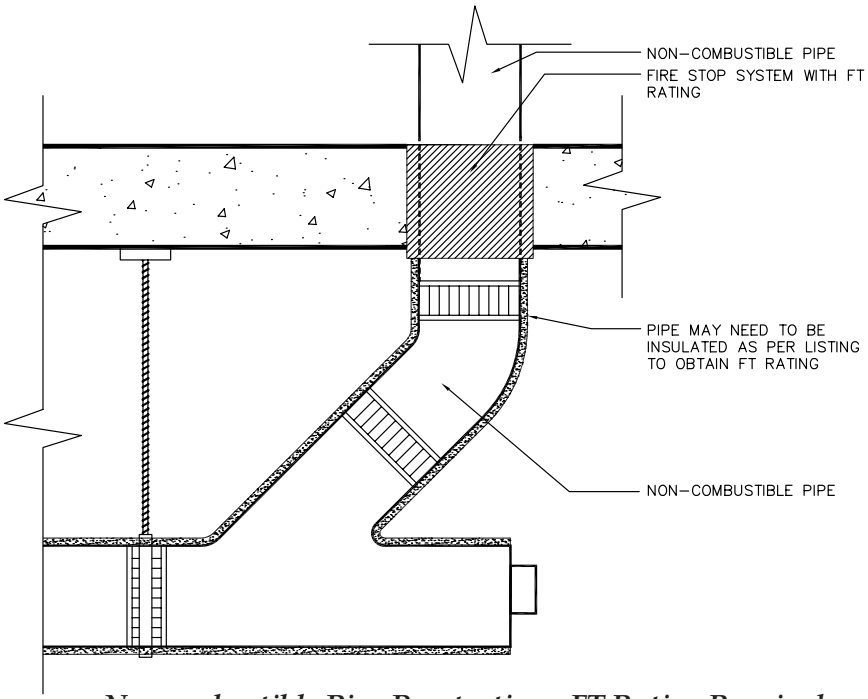
If meeting an FT rating is not possible, another alternative is to contain the piping in a horizontal shaft with a fire-resistance rating of two hours within the parkade. See the example in Figure 10 that shows how this could be done. When shafting services, the requirement for sprinklering and a minimum clear height of 2 metres (for the storage garage) need to be kept in mind when designing the structure (Sentences 3.3.5.4.(5) and (7)).

8



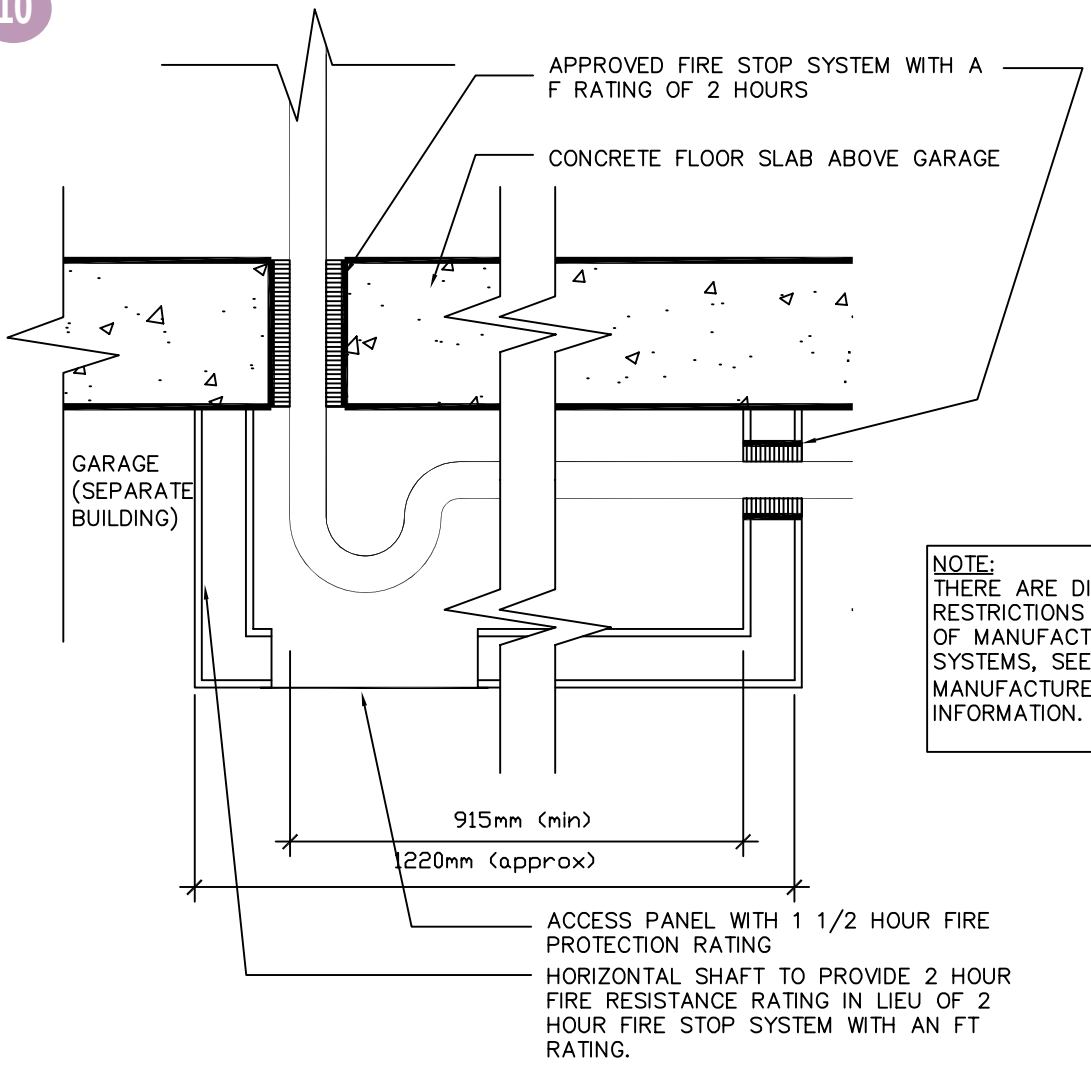
Combustible Pipe Penetration - F or FT Rating Required

9



Noncombustible Pipe Penetration - FT Rating Required

10

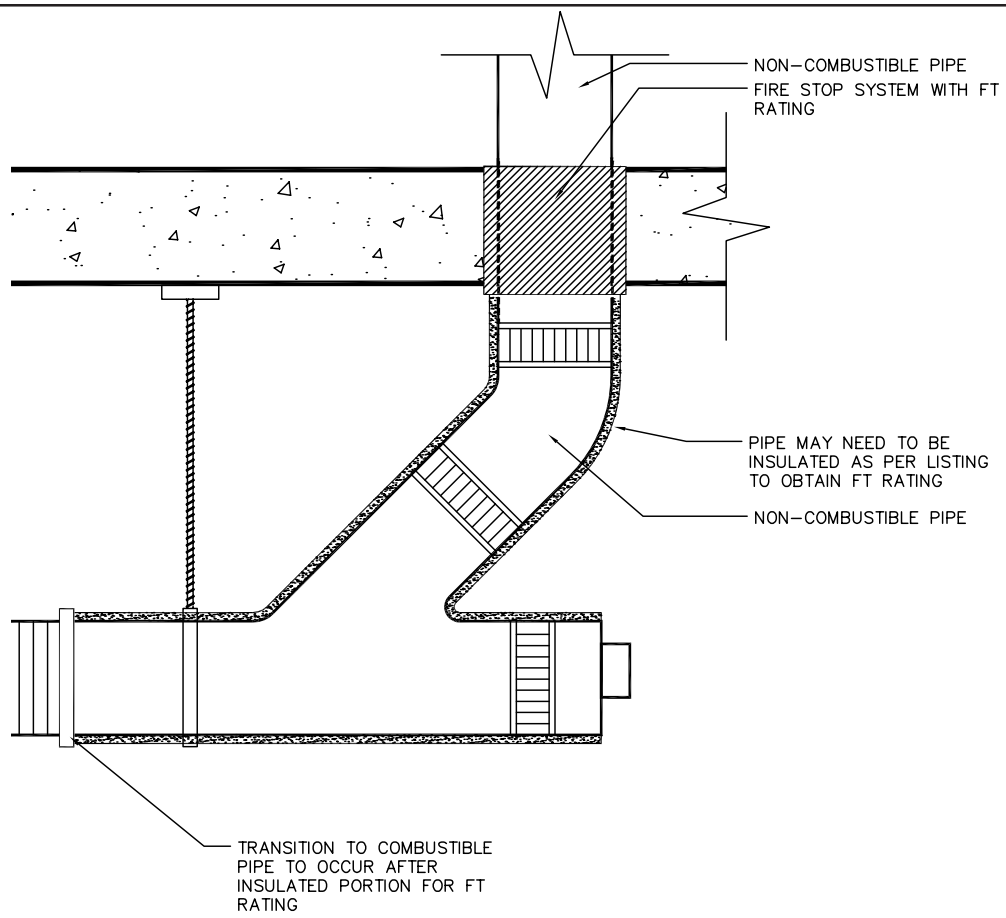


Pipe Penetration- Shafting to Meet the FT Rating

Combustible Piping Allowed in One Storey, One Fire Compartment Underground Garages

The *Alberta Building Code* allows certain exceptions on various issues. One of these allows piping to change from noncombustible to combustible pipe within a one storey, one fire compartment garage that is located in a basement (Sentence 3.1.9.4.(8)). This allows you to change from noncombustible to combustible pipe within a single storey garage. The exception was intended for after the pipe turned to the horizontal within the garage space. An example of how this can be used is shown in Figure 11. Also keep in mind that if the garage is classified as a separate building, then the noncombustible pipe may need to be insulated to meet the FT rating. See testing agency information to find an appropriate system design.

Another acceptable way to make this transition is shown in Figure 12a and 12b. The combustible pipe is fire stopped below the garage slab with an F or FT rating depending on whether the garage is classified as a separate building. A transition to noncombustible pipe is made above



Noncombustible Pipe Change to Combustible Pipe for a One Storey Garage

the slab. The vertical pipe is located in a shaft-like enclosure provided through the use of two layers of 15.9 mm type x gypsum board enclosing the pipe for one storey.

Toilets

There are a number of possible scenarios for toilet piping passing through garage slabs.

- **Toilet drain is passing through a garage slab where the garage is a separate building.**

  FT rating of 2 hours is required for either combustible or noncombustible pipe.

- **Toilet drain is passing through a garage slab where the garage is not part of a separate building.**

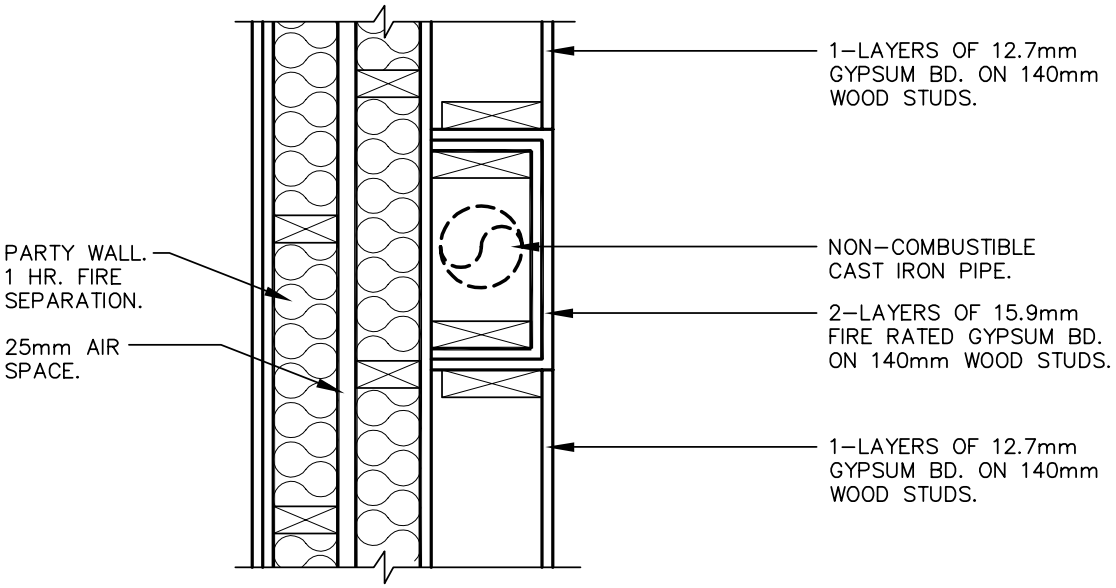
  Exception allows the combustible toilet drain to pass through the slab without using a tested fire stop system (Sentence 3.1.9.4.(5)). The combustible pipe leads directly through a concrete floor slab and ties into a combustible or noncombustible vent stack.

- **Toilet drain is passing indirectly through the garage slab, through a wood sleeper system.**

  If the garage is a separate building, an FT rating of 2 hours is required for either combustible or noncombustible pipe. If the garage is part of the same building, an F rating of 1½ hours is required for combustible pipe or 1 hour for noncombustible pipe.

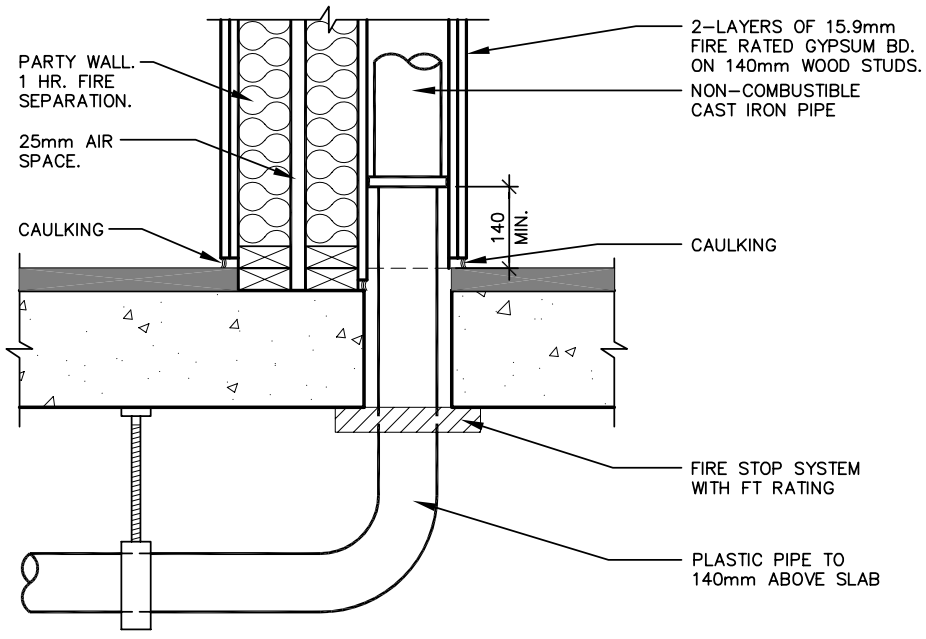
Three examples of toilets penetrating a garage concrete floor are shown in Figures 13, 14, and 15.

12a



PLAN VIEW

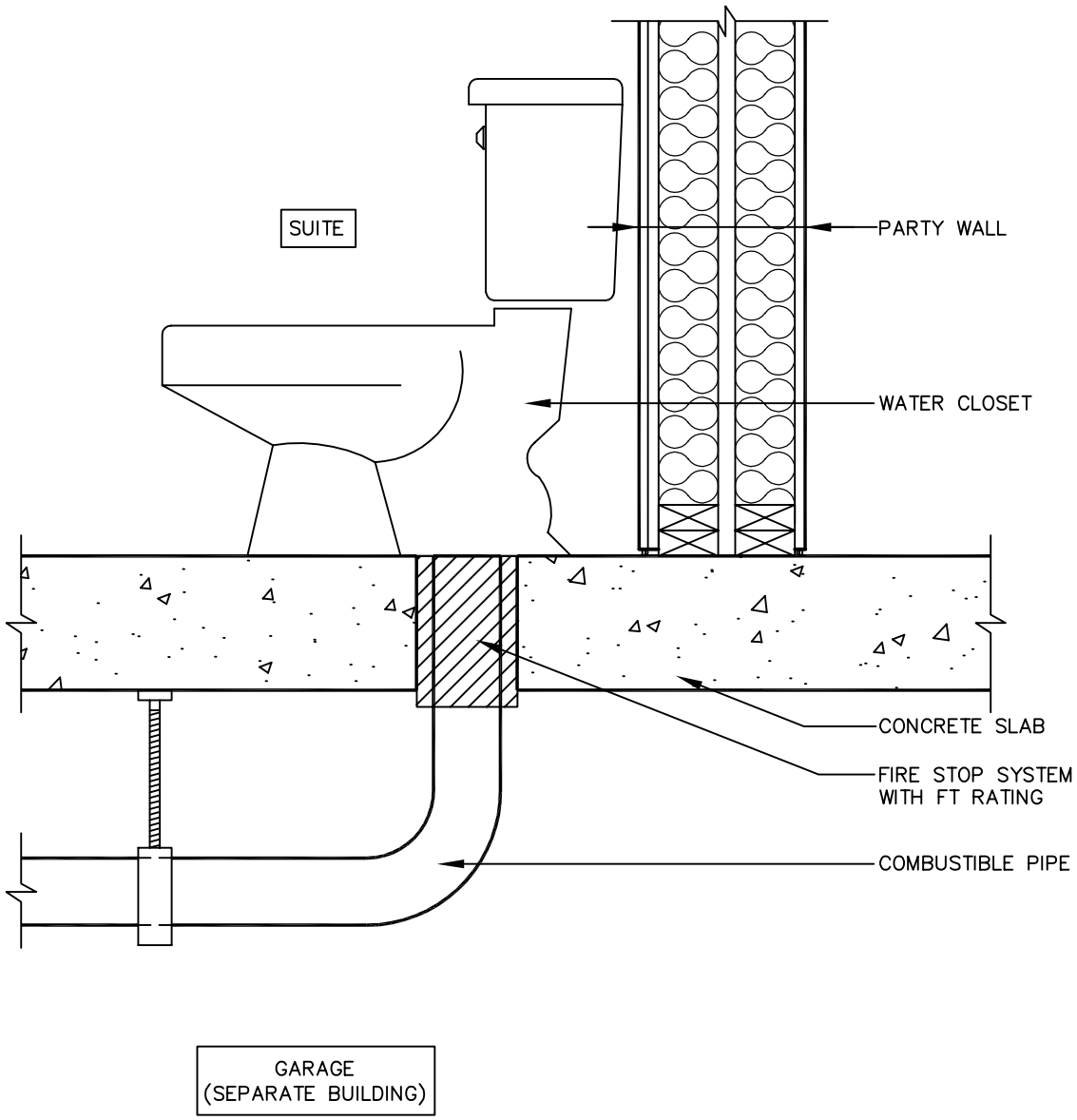
12b



SECTION

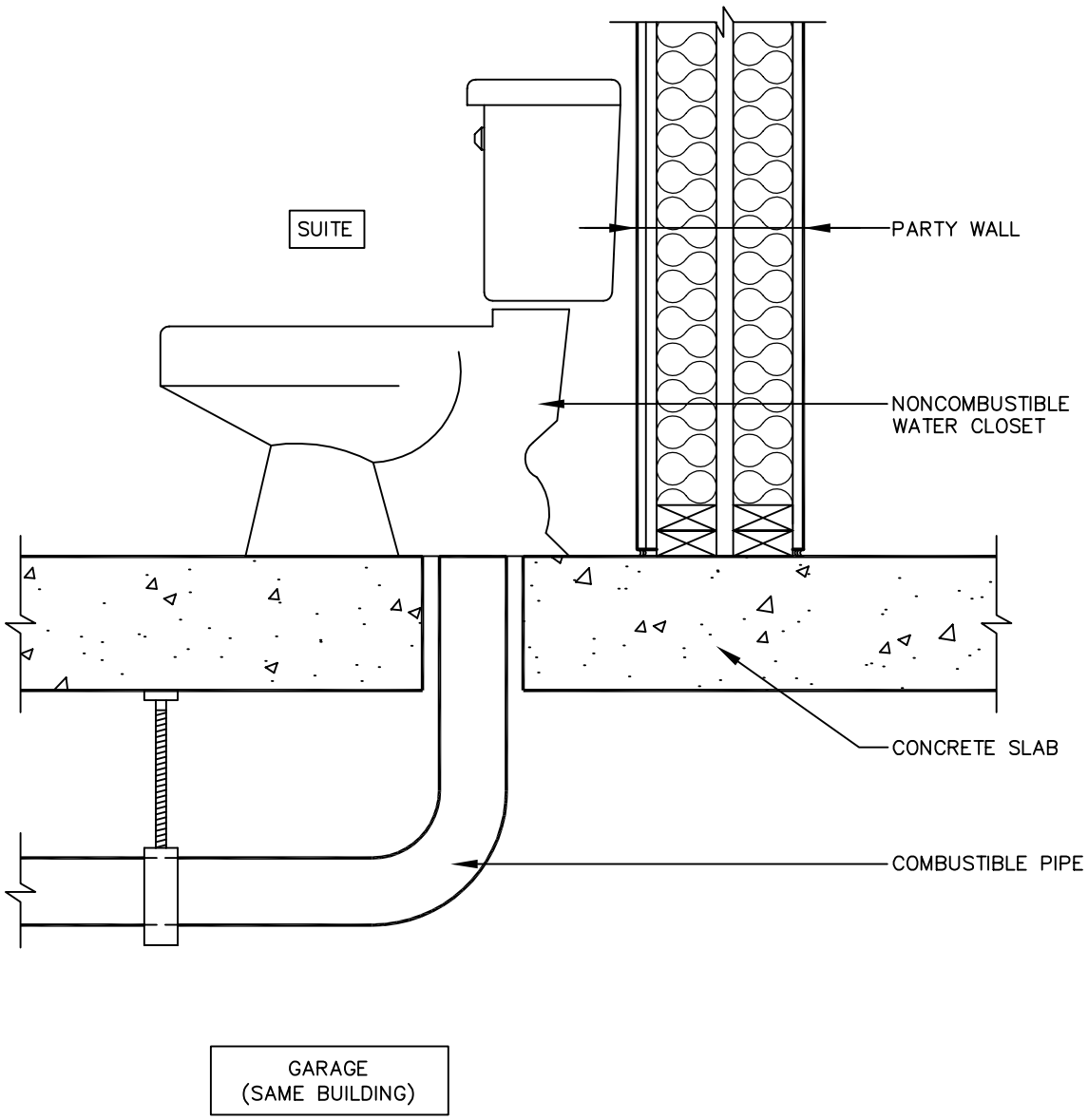
Noncombustible Pipe Change to Combustible Pipe for a One Storey Garage

13



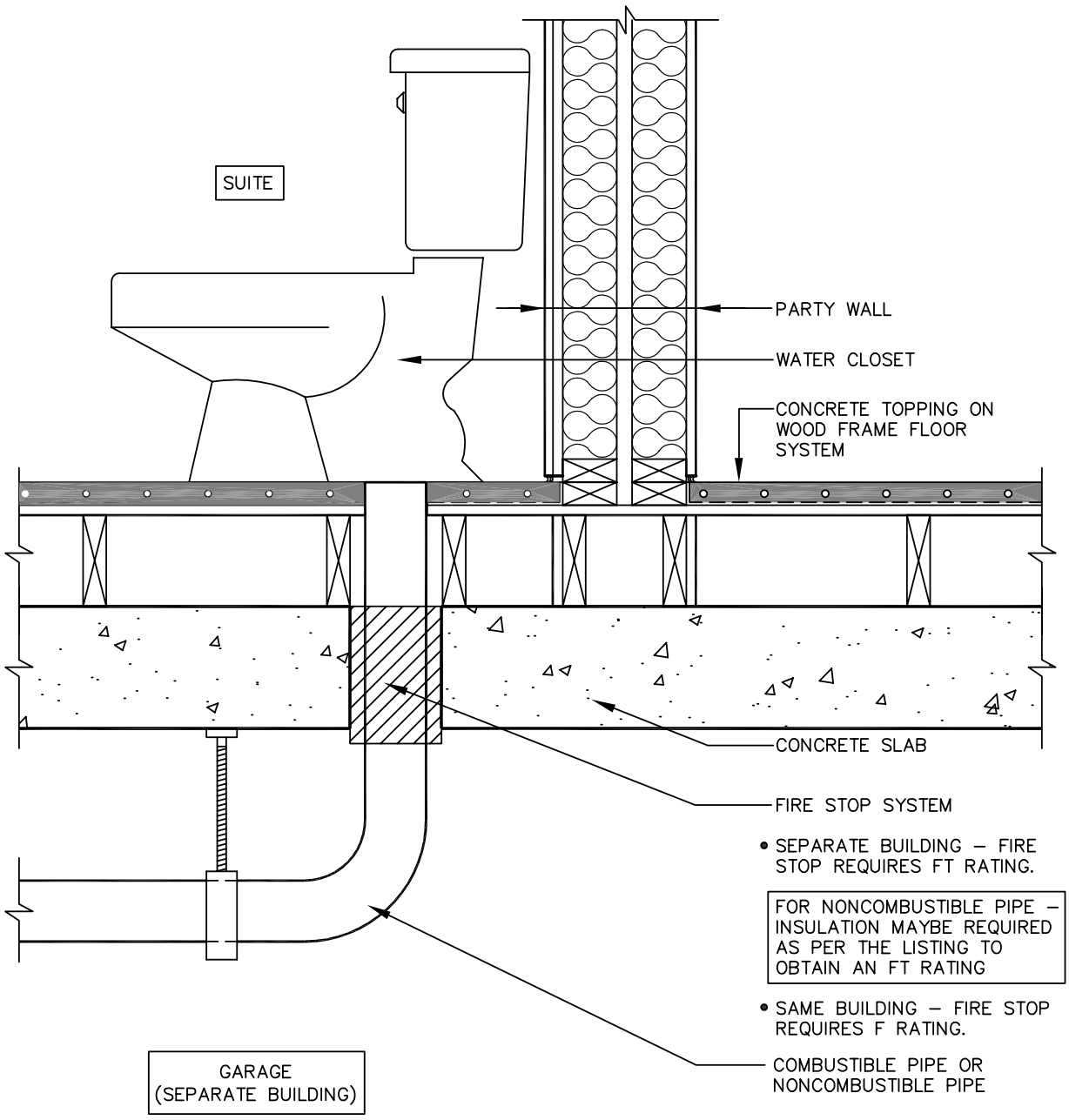
Toilet Penetration - FT Rating Required

14



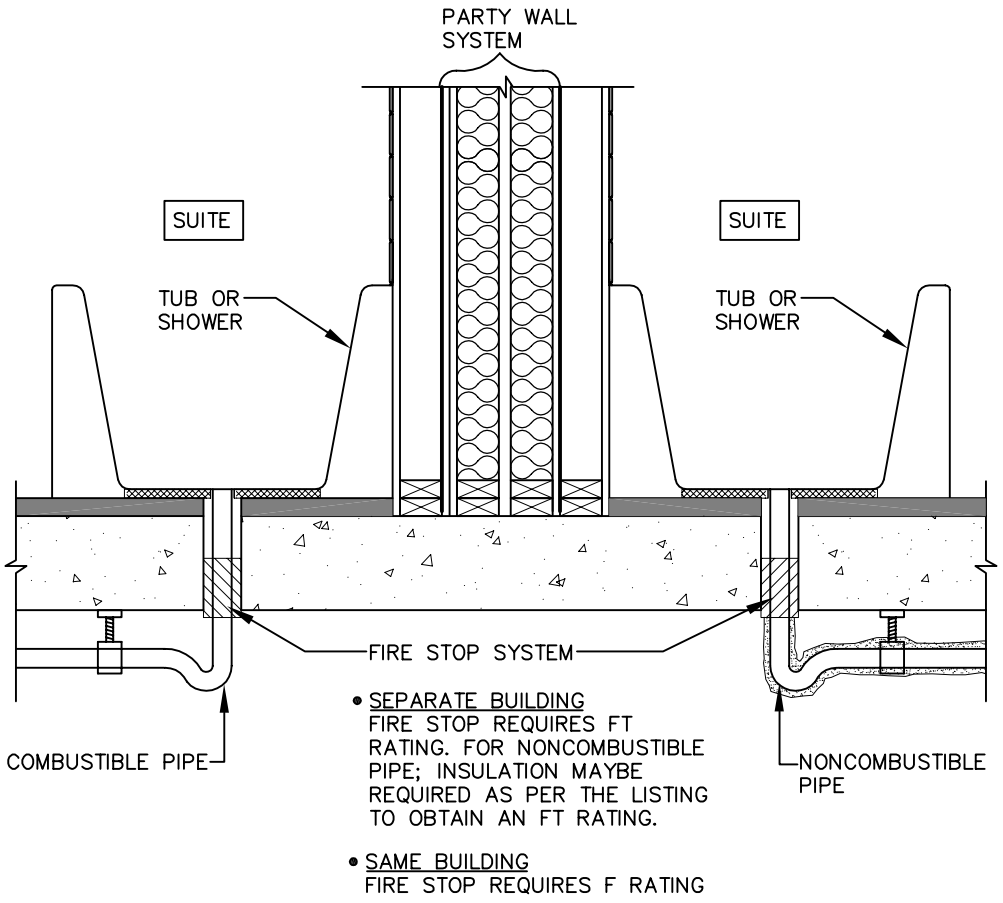
Toilet Penetration Directly Through Slab - No FT Rating Required

15



Toilet Penetration Through Wood Sleeper Floor - F or FT Rating Required

16



Tub / Shower Penetration - F or FT Rating

Tub / Shower Penetrations

There are two main scenarios for tub/shower penetrations through garage floors.

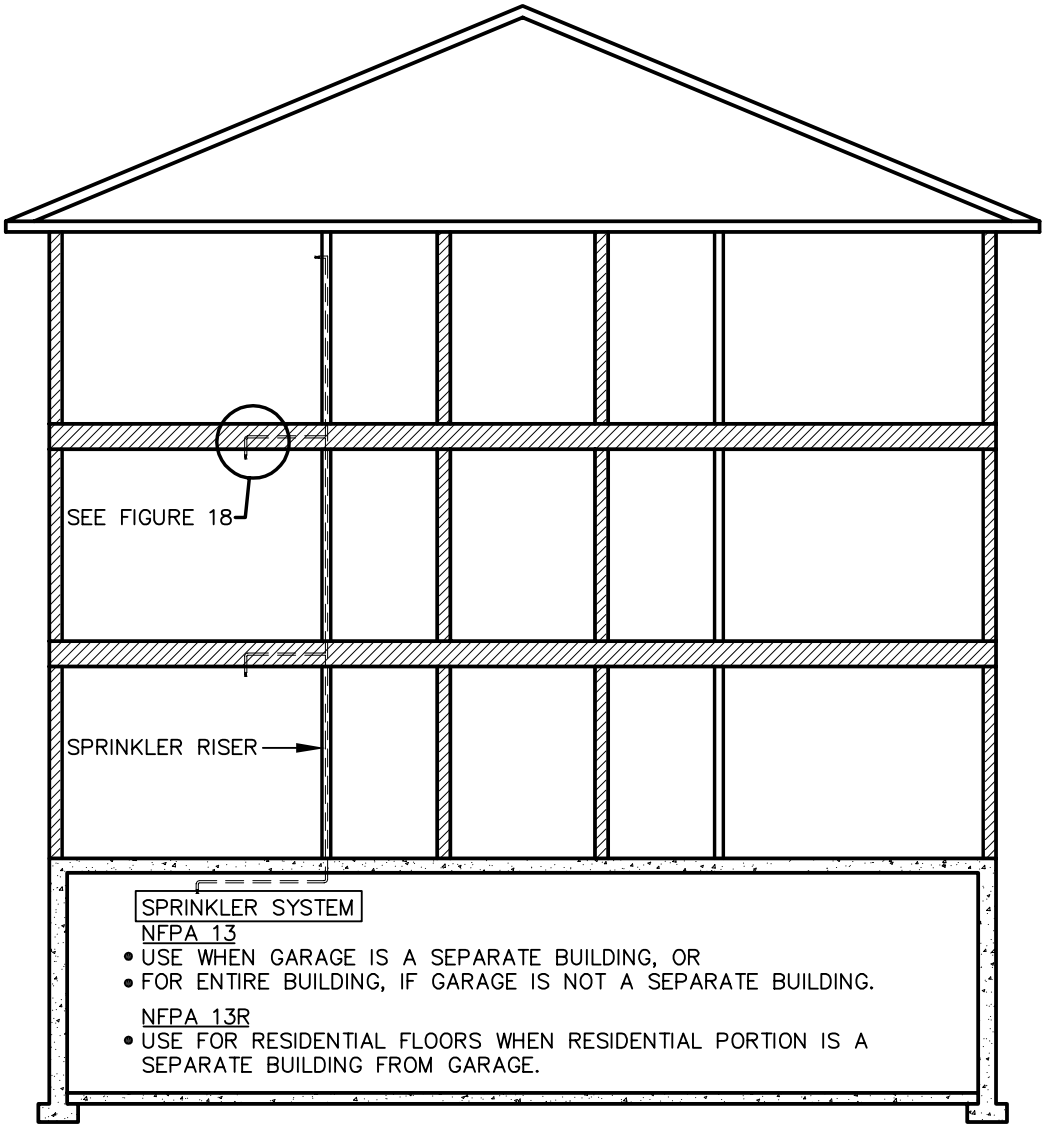
- **Tub / shower is passing through a garage slab where the garage is a separate building.**

  FT rating of 2 hours is required for either combustible or noncombustible pipe.

- **Tub / shower is passing through a garage slab where the garage is not part of a separate building.**

  F rating of 1½ hours is required for combustible pipe or 1 hour for noncombustible pipe.

17



Overview of a Sprinkler Piping System

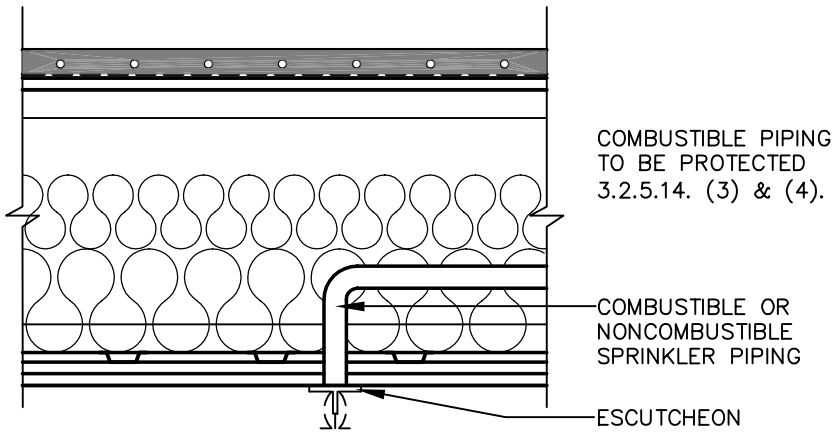
Other Floors and Walls

Sprinkler Piping

Sprinkler piping is required to be noncombustible except that combustible sprinkler piping is allowed as outlined in Sentence 3.1.9.4.(1) and Article 3.2.5.14. Sprinkler system piping can be combustible and penetrate fire separations if:

- Fire compartments on each side are sprinklered,
- It is a wet system in a residential or other light hazard occupancy,
- Combustible sprinkler piping meets the requirements of ULC/ORD-C199P, "Combustible Piping for Sprinkler Systems", and
- Piping is separated from the area it serves by ceiling, walls or soffits as outlined in 3.2.5.14.(3).

18



Combustible Sprinkler Piping Penetrating a Membrane Forming Part of a Fire Separation

All sprinkler piping whether it is combustible or noncombustible must be fire stopped with an appropriate fire stop system.

In parking garages and garbage rooms, noncombustible sprinkler piping is often used because the piping is left exposed and the use of these areas is more than light hazard.

Where sprinkler piping penetrates a ceiling membrane, it should be tightly fitted and covered with an escutcheon, but not fire stopped (See Figure 18). Intumescent fire stop products could potentially interfere with the operation of the sprinkler.

Water Distribution Piping

Water distribution piping is required to be noncombustible except for the following:

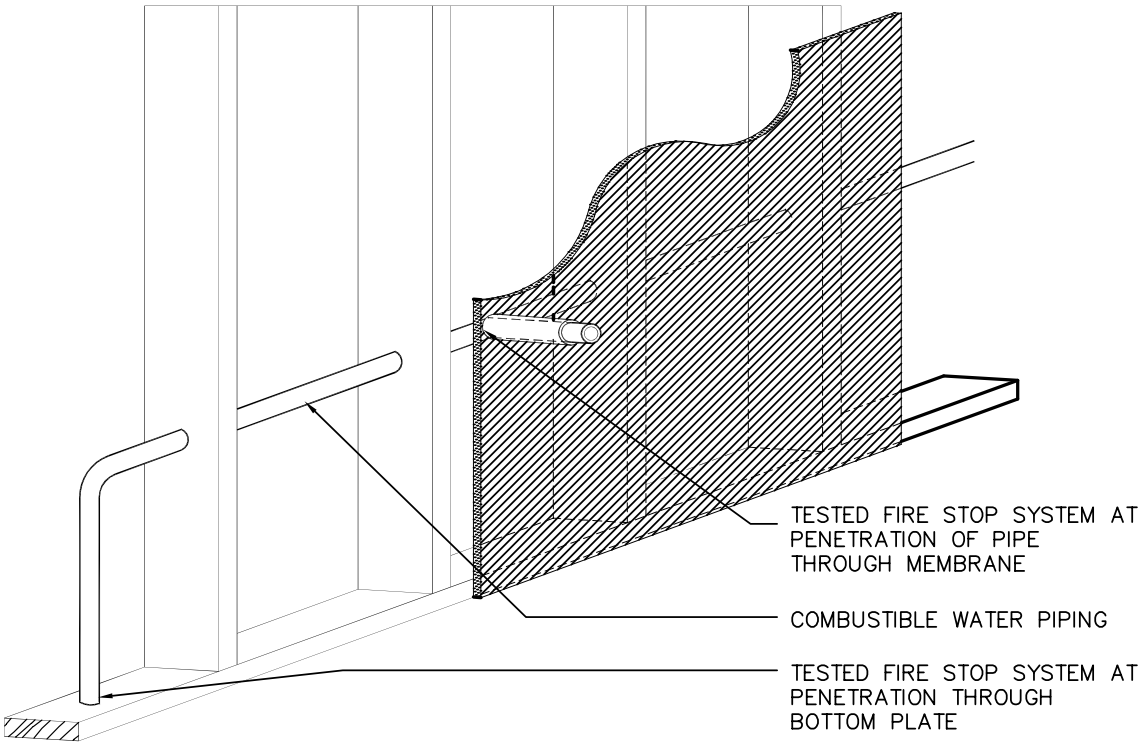
- Combustible piping is incorporated into a tested assembly (Article 3.1.9.2.), or
- Combustible piping with an outside diameter of 30 mm or less penetrates a vertical fire separation (Sentence 3.1.9.4.(2)).

All water distribution piping whether it is combustible or noncombustible must be fire stopped at the membrane forming part of a fire separation or at fire separation penetrations with an appropriate fire stop system.

Horizontal sections of water pipe may be placed in double-stud wall fire separations provided the structural aspect of the wall is not compromised. No vertical risers are allowed in these walls.

See the example in Figure 19 of water distribution piping penetrations.

19



Water Distribution Piping Penetrating Through a Bottom Plate and Wall Membrane

HOT TIP

Can I Use Combustible Water Distribution Pipe in the Garage?

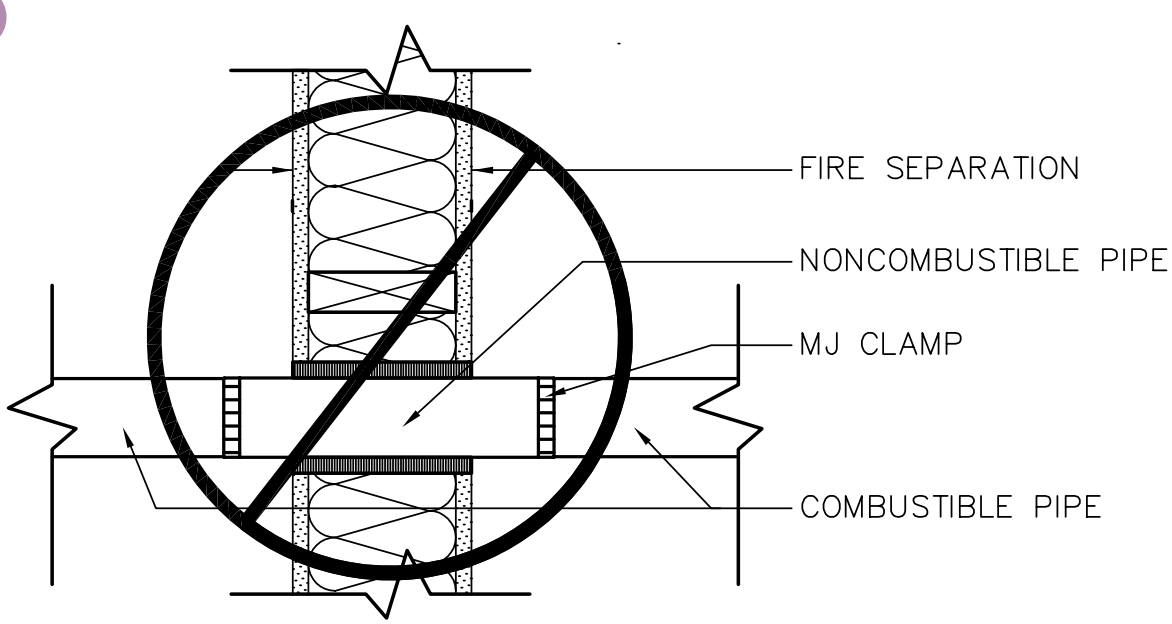
Where the water main enters the building, the water supply is often split into supplies for:

- domestic use; and
- fire protection use.

Domestic water lines require noncombustible pipe for the meter and by-pass assembly (The City of Calgary - Standard Specifications - Waterworks Construction). Beyond the meter and by-pass assembly the pipe could be either combustible or noncombustible, provided the piping material conforms to the Canadian Plumbing Code. Please note that the fire stop system for all pipes requires an FT rating where penetrating the basement slab if the garage is classified as a separate building from the building above it.

Sprinkler piping in an underground garage is installed as an all noncombustible system, because piping is left exposed and the hazard type for this occupancy does not allow exposed combustible sprinkler piping.

20



Noncombustible Pipe Sleeves Through Fire Separations Changing to Combustible Pipe on Both Sides - Not Allowed

Vacuum System Piping

Vacuum system piping is allowed in a similar manner to combustible drain waste and vent piping (Sentence 3.1.9.1.(1) and 9.10.9.6.(9)).

All vacuum system piping whether it is combustible or noncombustible must be fire stopped with a tested fire stop system.

The most critical thing to remember is that in addition to passing the CAN4-S115-M "Standard Method of Fire Tests of Fire Stop Systems", all vacuum system pipe also needs to meet 50 pascals (Pa) pressure differential during the fire test (Sentence 3.1.9.4.(4)).

Drain, Waste and Vent Piping

General Information

Install drain, waste and vent piping as either a totally combustible system or totally noncombustible system.

There are four exceptions where noncombustible drain, waste and vent piping may be changed over to combustible piping:

- Combustible drain piping allowed through a concrete floor slab provided it leads directly from a noncombustible water closet (Sentence 3.1.9.4.(5)).

- Horizontal pipe runs between fire compartments (intended for large fire compartments (Sentence 3.1.9.4.(6)).
- Noncombustible pipe risers changing to combustible pipe outside of the shaft (Sentence 3.1.9.4.(7)).
- Horizontal pipe runs within one storey, one fire compartment basement storage garages (Sentence 3.1.9.4.(8)).

The exceptions for storage garages and toilet drains have been illustrated in the previous section (See Figures 12a, 12b, and 14). The two other exceptions are explained and illustrated at the end of this section.

All drain, waste and vent (DWV) piping whether it is combustible or noncombustible must be fire stopped with a tested fire stop system. Installing small sections (sleeves) of noncombustible pipe through fire separations and then continuing with combustible pipe on either side is not allowed (See Figure 20).

The most critical thing to remember about combustible drain, waste and vent piping is that in passing the fire test using CAN4-S115-M "Standard Method of Fire Tests of Fire Stop Systems", DWV pipe needs:

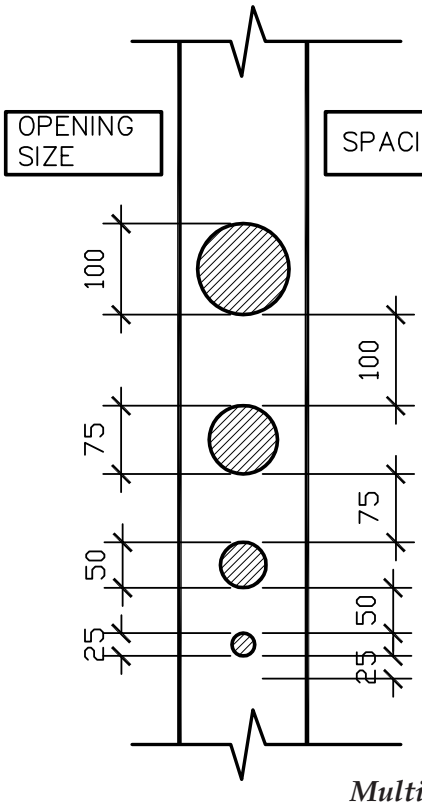
- An F rating with the same fire-resistance rating as the fire separation it penetrates, and
- To withstand 50 pascals (Pa) pressure differential during the test (Sentences 3.1.9.4.(4) and 9.10.9.7.(2) and (3)).

HOT TIP

Good Design for Interior Walls Inside Suites

Pipes may need to be located in walls having a fire-resistance rating because most manufacturers' tests of fire stop system specify that pipes be contained in walls with a fire resistance rating. If you are using piping and fire stop systems that require this, it makes the job easier and prevents mistakes if 12.7 mm (½") or 15.9 mm (⅝") type X gypsum board is installed on all walls, depending on the fire-resistance rating required for the floor. This gives trades the option of installing any service in any of the interior walls without having to be concerned about whether the wall is rated.

21



WALL PLATE SIZE	PIPE SIZE
38 x 89 mm (2x4)	≤ 50 MM NOMINAL PIPE SIZE
38 x 140 mm (2x6)	> 50 MM NOMINAL PIPE SIZE

Multiple Pipes - Plan View

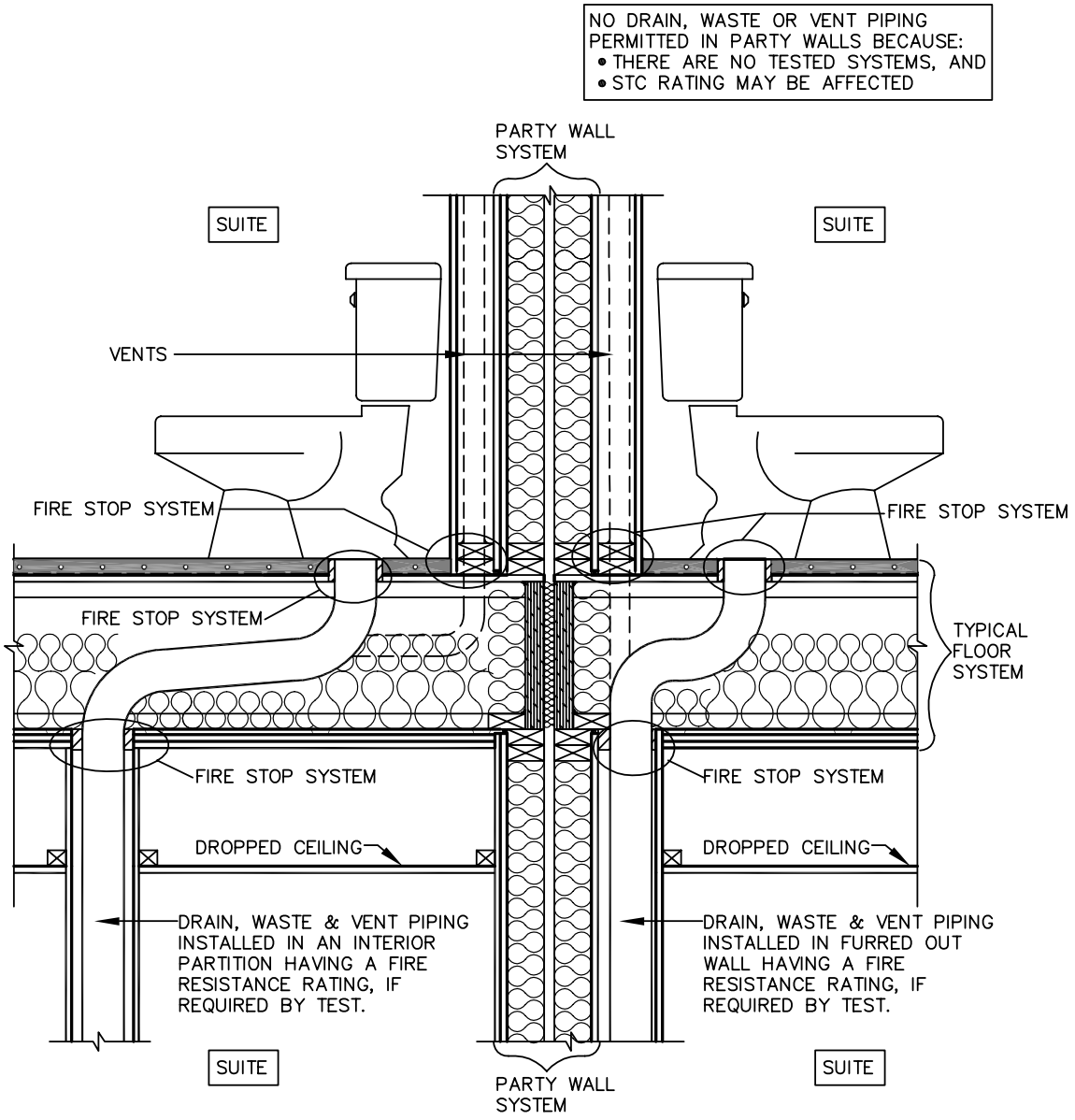
Pipe Sizes, Wall Plate Sizes and Pipe Spacings

Top and bottom plates can be completely riddled by pipes passing through, if no pre-planning is done. To maintain structural strength of the wall, as well as give a reasonable amount of space to install fire stop systems, pipes should be spaced at least the same diameter apart as the larger adjoining pipe, unless you are using a fire stop system that allows multiple pipes within the same space. In this case, follow the spacing shown by the manufacturer in the test. See the example of pipe spacing in Figure 21.

Also of concern is the width of the wall plates in relation to the pipes passing through them. When larger pipes are running in a wall, larger wall plates should be used. Nominal pipe sizes with diameters over 50 mm (2") should be located in a minimum of 38 x 140 mm (2 x 6) walls. Keep in mind that in addition to the hole for the pipe, an annular space also needs to be provided into which to insert the fire stop system.

Pipe Size	Size of Wall Plate
50 mm (2") or less (nominal pipe size)	38 x 89 mm (2 x 4)
Over 50 mm (2") (nominal pipe size)	38 x 140 mm - or greater as required (2 x 6 or greater)

22



Toilet Penetrations Through Wood Floor Assembly

Toilets

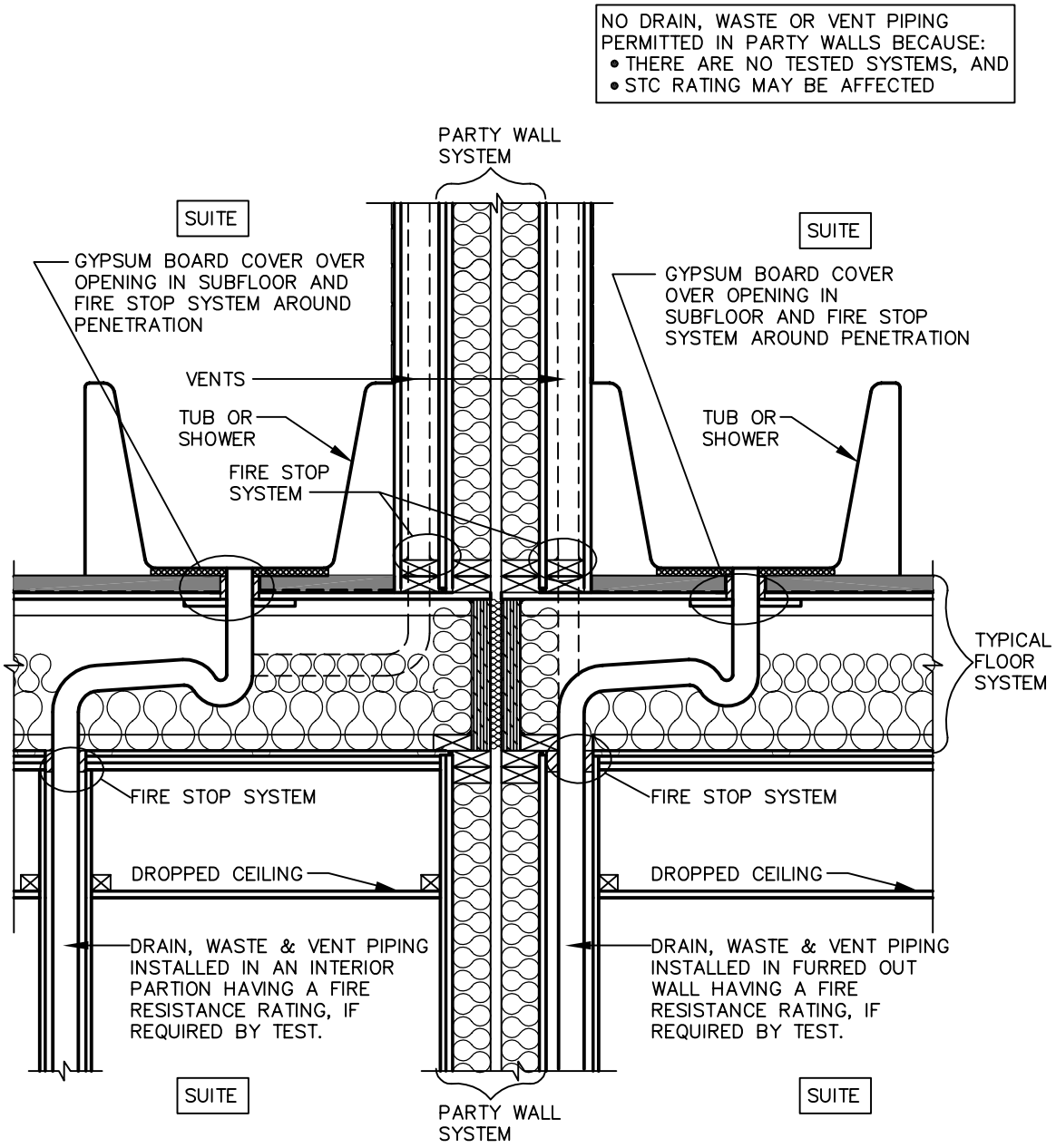
Drain pipes for toilet generally run within a floor assembly until they reach the nearest stack.

The following areas require fire stopping using a tested fire stop system:

- Around the drain opening where the toilet is set on the floor;
- At the top and bottom plates of the rated wall assembly where the vertical DWV passes through; and
- At any point where the pipe passes through a drywall membrane which forms a part of a fire separation.

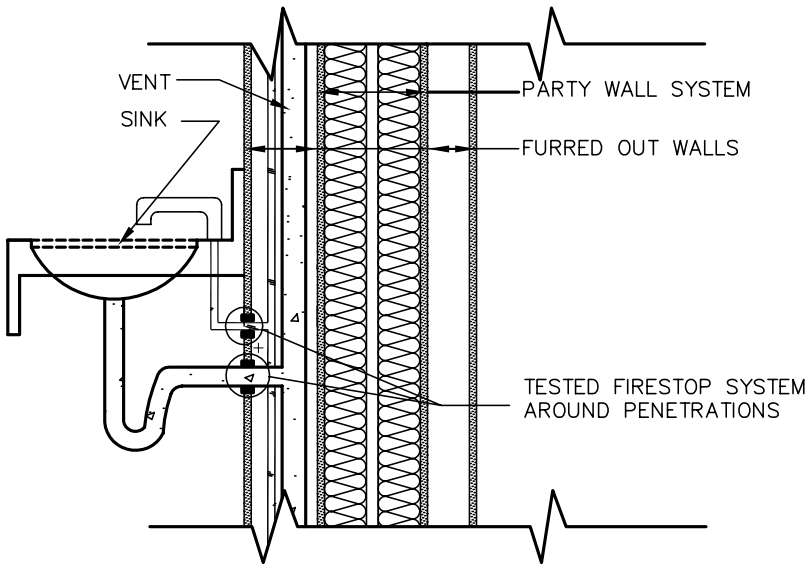
See the example in Figure 22.

23



Tub / Shower Penetration Through Floor

24



Sink Drain Penetration into a Wall Cavity

Tubs / Showers

The same principle applies here as to toilet penetrations. Normally 5/8" type X gypsum board is used to close the square hole that has been cut for the drain.

The following areas require fire stopping using a tested fire stop system:

- Around the drain opening where the tub / shower drain penetrates the floor assembly,
- At the top and bottom plates of the rated wall assembly where the vertical DWV pipe passes through, and
- At any point where the pipe passes through a membrane which forms a part of a fire separation.

See the example in Figure 23.

Sinks

Short horizontal DWV pipes, that return to vent stacks from sinks, may be placed in double-stud wall fire separations provided the structural aspect of the wall is not compromised. No vertical stacks are allowed in these walls. For vertical DWV stacks:

- Locate services in another wall within the suite, or
- Locate services in a furred out wall in front of the fire separation wall assembly requiring an STC rating.

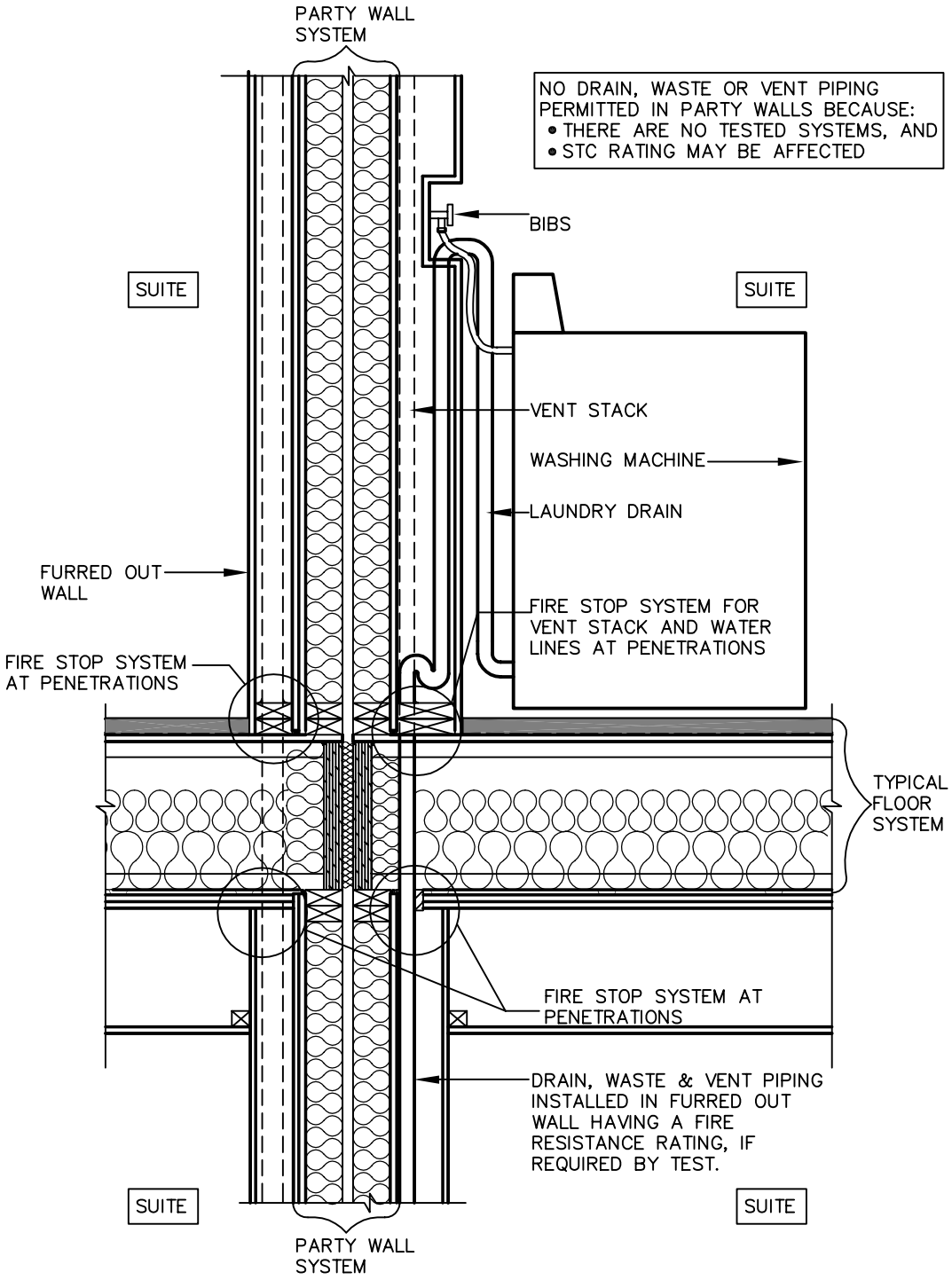
You also need to check whether the vertical DWV from the sink needs to be in a rated wall. Many fire stop systems are tested in rated walls. Check the manufacturer's listing for more information.

The following areas require fire stopping:

- Where the drain pipe passes through a membrane which forms a part of the wall separation, and
- At the top and bottom plates of the rated wall assembly where the vertical DWV passes through.

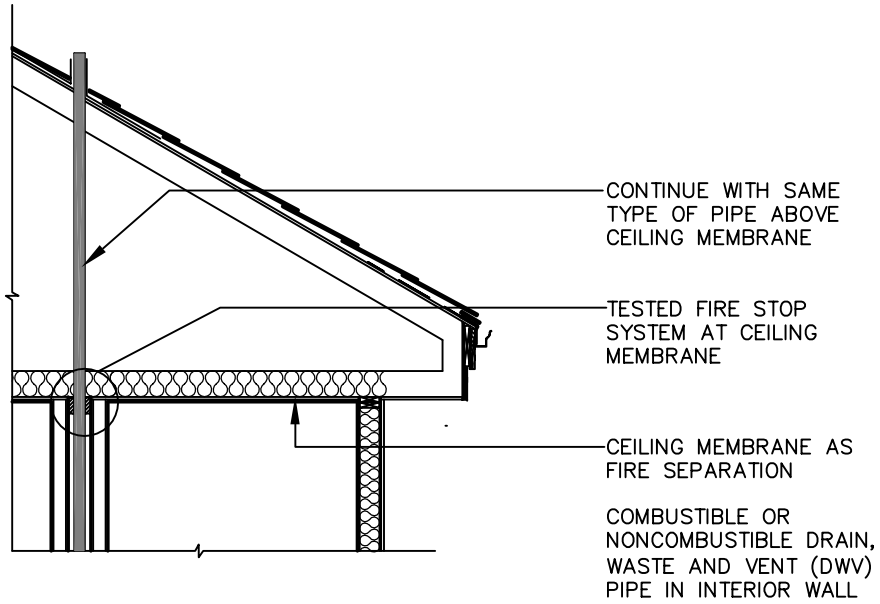
See the example in Figure 24.

25



Laundry Room - Water Piping and Drain

26



Pipe Penetrations into Attic Spaces

Laundry Rooms

Locate laundry room water line and vent stacks in walls other then party walls or public corridor walls. You may locate services in:

- Another wall or service space within the suite, or
- A furred out wall in front of the fire separation wall assembly requiring fire-resistance and STC rating.

Check whether the vertical DWV from the washing machine needs to be in a rated wall. Many fire stop systems are tested in rated walls. Check the manufacturer's listing for more information.

The following areas require fire stopping:

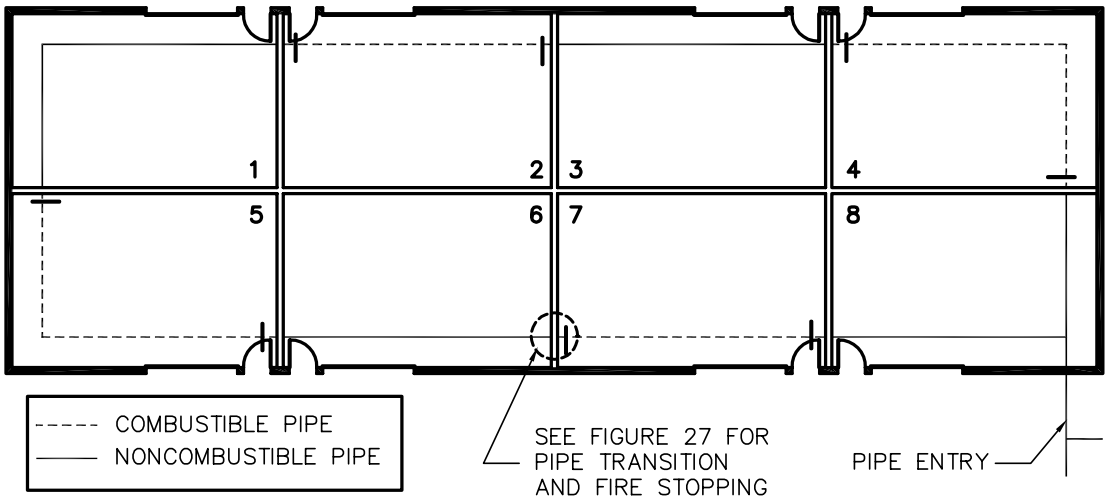
- Where the water pipes and drain pipe pass through a membrane which forms a part of the wall separation, and
- At the top and bottom plates of the rated wall assembly where the vertical DWV and water pipes pass through.

See the example in Figure 25.

Attics

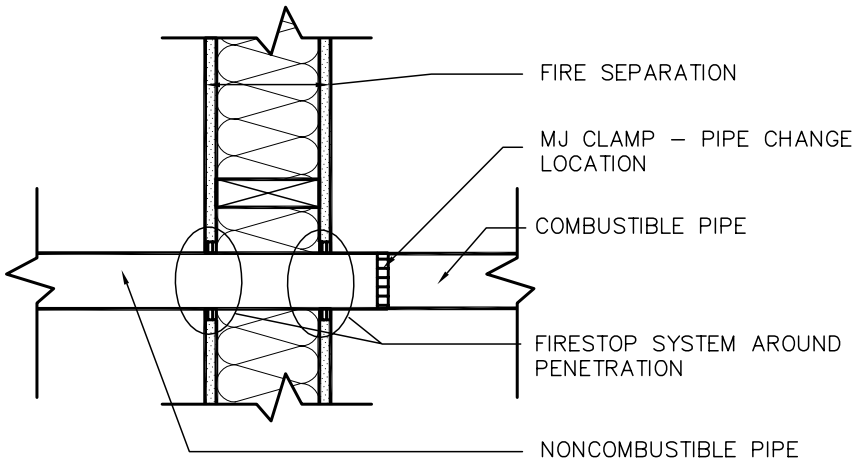
When the drain, waste, vent (DWV) pipe comes to the ceiling of the top floor, it needs to be fire stopped where it passes through the ceiling membrane and into the attic space. No changes in the type of DWV pipe are permitted. See the example in Figure 26.

27



Plan View - Pipe Transitions Between Fire Compartments

28



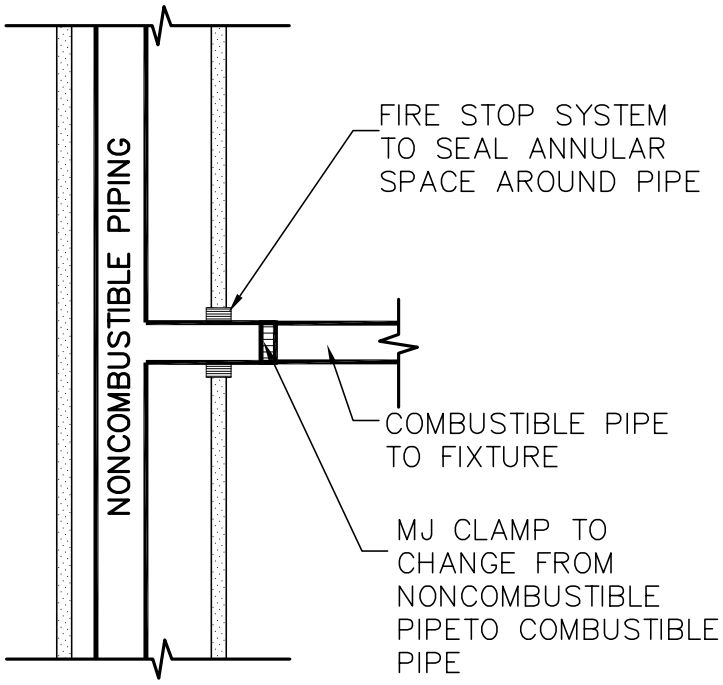
Detail - Pipe Transitions Between Fire Compartments

Changing Pipe Types in Horizontal Pipe Runs Between Fire Compartments

There is an exception in the *Alberta Building Code* which allows combustible drain, waste and vent pipes (DWV) in different fire compartments to alternate between combustible and noncombustible (Sentences 3.1.9.4.(6) and 9.10.9.7.(5)). This article is intended for compartments where the width of the fire compartment is quite large, such as in industrial warehouses. The noncombustible pipe should pass completely through all vertical separations and the switch to combustible should be made inside the fire compartment. Where the noncombustible pipe passes through the fire separation, a fire stop system must still be provided.

See the example in Figures 27 and 28.

29



Noncombustible Pipe Riser Change to Combustible Pipe

Noncombustible Pipe Risers Changing to Combustible Pipe Outside of the Shaft

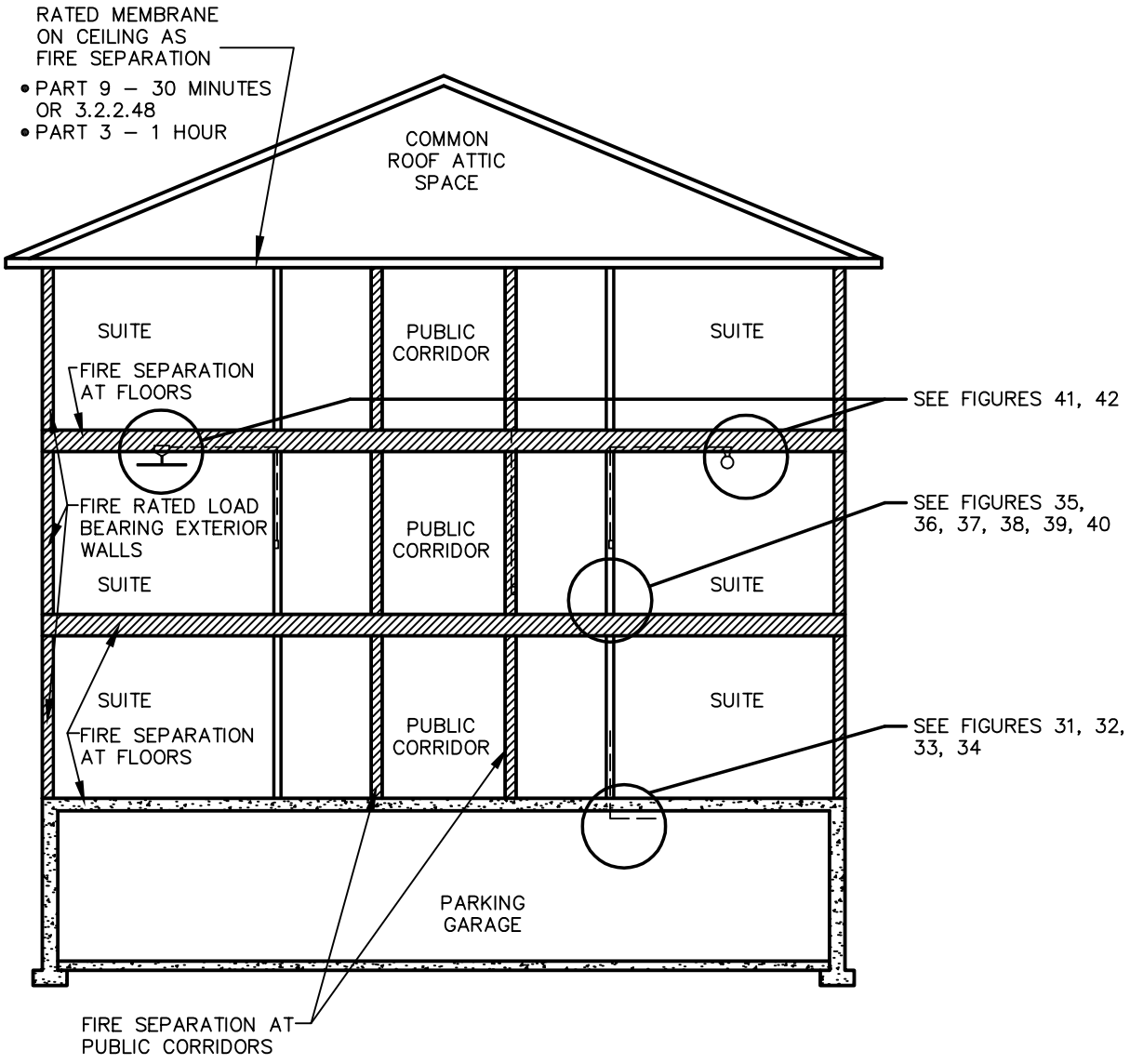
There is an exception in the *Alberta Building Code* which allows a noncombustible drain, waste, vent pipe in a vertical shaft or vertical fire separation to change over to combustible piping to make connections to plumbing fixtures where the pipe has exited the membrane (Sentence 3.1.9.4.(7)). Connections can be made to fixtures on both sides of the fire separation.

See the example in Figure 29.

Part 2A - Pipe Penetrations

PART 2B
ELECTRICAL PENETRATIONS

30



Typical Building Showing Electrical Services

Overview

Opposite is an illustration of a building showing various electrical installations.

The number of wires now installed in buildings has grown enormously over the past five to ten years. Wire installations in buildings now include but are not limited to:

- Electrical wiring for lights, switches, outlets;
- Communication wiring including telephone, internet and intercom;
- Security systems; and
- Sound systems.

For individual and small penetrations, fire stop systems around electrical wiring consist of fire stop caulk and may require a mineral wool backing. See the general information about fire stop systems beginning on page 13. Larger systems with multiple penetrations may involve different types and depths of caulk and other fire stop components. Each system is individual and must be used as specified by the manufacturer's test.

HOT TIP

Abandoned Openings

Sometimes a hole is cut in error and pipe, wire or mechanical equipment is not installed through the opening. When this occurs, close the opening using the same type of fire resistive construction used to construct the original fire separation. Alternatively, a fire stop system tested for this purpose could be used to seal the opening.

Garages

General Information

Garages may be single or multi-storey structures. In multi-storey garages although the *Alberta Building Code* allows ramps, the floors are still considered fire separations and this requires that penetrations through the floors be fire stopped.

The most critical item to be considered when wires pass through the floor slab above the garage, is whether the wiring passing through this slab requires an F rating or an FT rating. This is dependant on whether the garage is part of the same building or a separate building from the building above it. The F and FT ratings required are outlined below.

Garage Classification	Fire Stop		
Fire Separation Fire-Resistance Rating	**F Rating** Most Services	**F Rating** Combustible DWV (Pressure - 50 Pa)	**FT Rating** Floor/Ceiling (Article 3.2.1.2.) Firewalls
Same Building			
1 ½ hour	1 hour	1 ½ hour	not applicable
Separate Building			
2 hour	not applicable	not applicable	2 hour

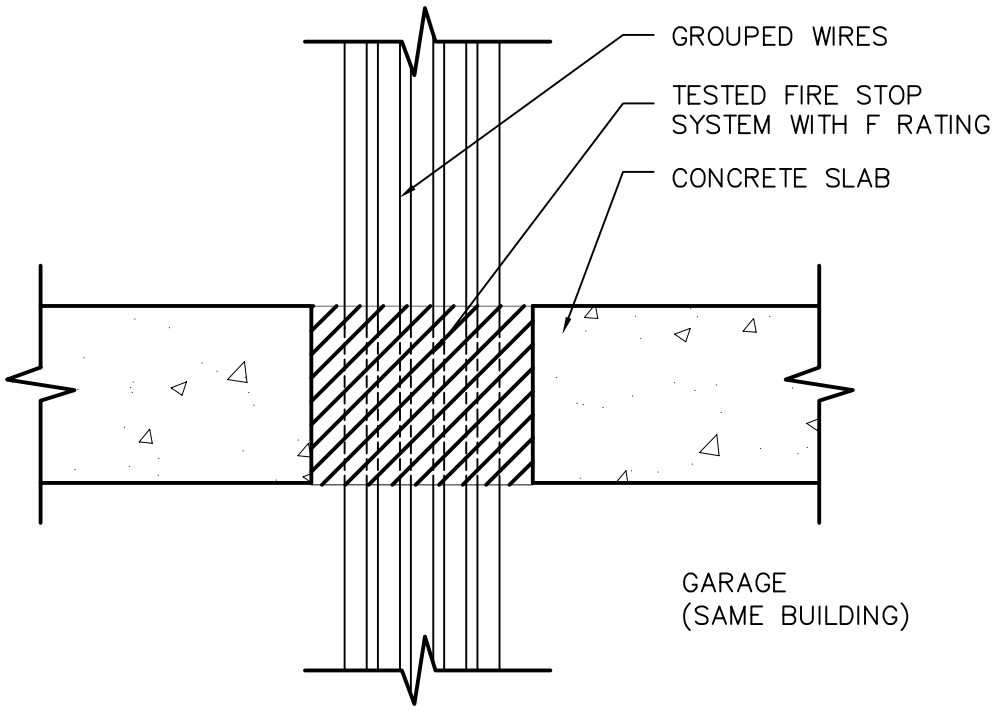
If the garage is a separate building, it means that the fire stop systems are required to have an FT rating. FT ratings are significantly more difficult to achieve and less designs are available to choose from.

To meet FT ratings, the possible solutions are:

- Small groups of wires may not require electrical metallic tubing (EMT) to obtain an FT rating. Check the manufacturers' fire stop system;
- Enclosing the wire and insulating it with one of the few systems available. The number of systems that allow this are very limited. The system must be used exactly as tested by the manufacturer;
- Enclosing the wire in a horizontal shaft and then distributing it after it passes through the slab between the garage and the main floor; and
- Keeping all the wiring that needs to pass through the slab in the electrical room in the basement. Upgrading the basement electrical room rating to two hours and with this increased protection, just providing an F rating of two hours where the wires penetrate the floor from this room.

See the examples of how the wire would appear where passing through the garage floor in Figures 31, 32, 33 and 34.

31



Wire - No FT Rating Required

HOT TIP

Classifying a Garage as a Separate Building - FT Rating Required

Many designers choose to classify the garage as a separate building from the structure above it using Sentence 3.2.1.2., particularly when designing multi-family buildings. There are a number of reasons for making this choice. Two of the major reasons are:

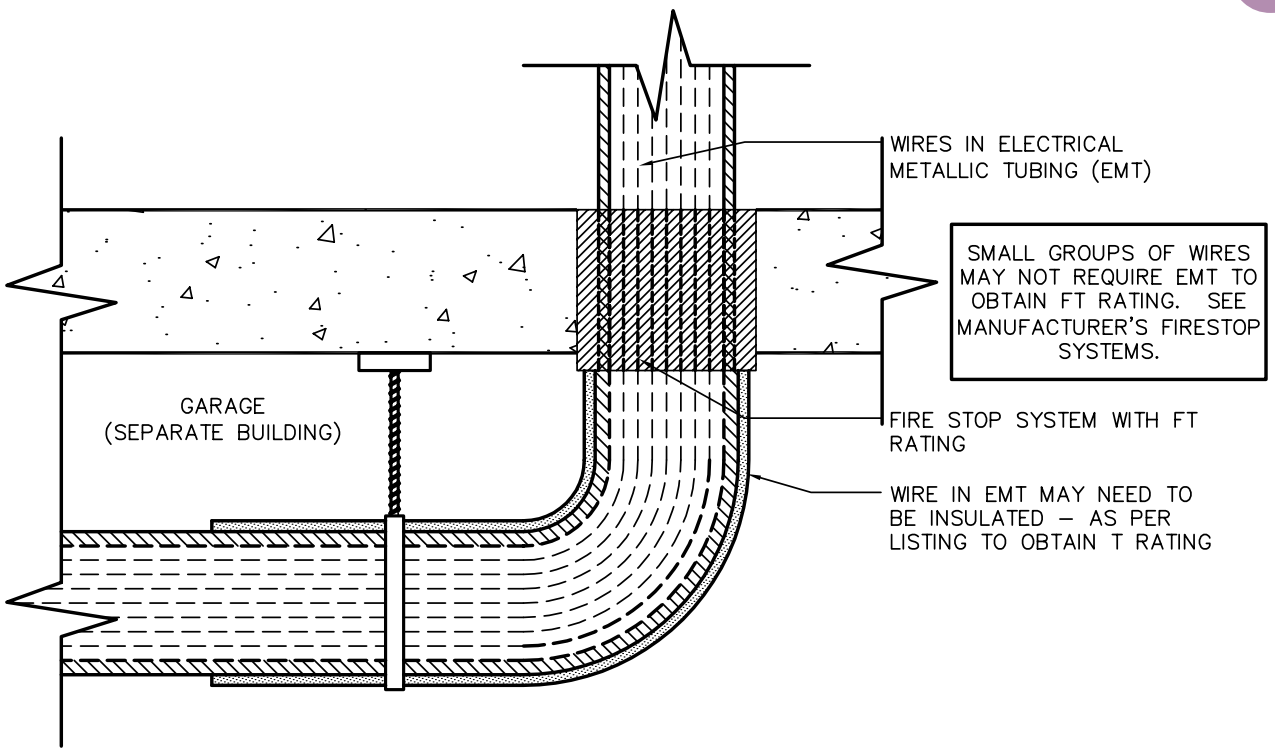
- The ability to place a number of smaller buildings over a larger garage.

  If you classify the garage separately, you can often place a number of buildings over the top of a common garage area, without having to use the large garage area to classify the entire building.

- The use of different NFPA codes for the design of the sprinkler system in the garage and a multi-family building above.

  By classifying the garage separately, designers are also allowed to use NFPA 13 to design the sprinkler system in the garage portion, while the less restrictive NFPA 13R may be used to design the building above, if it is residential.

32



Wire - FT Rating Required

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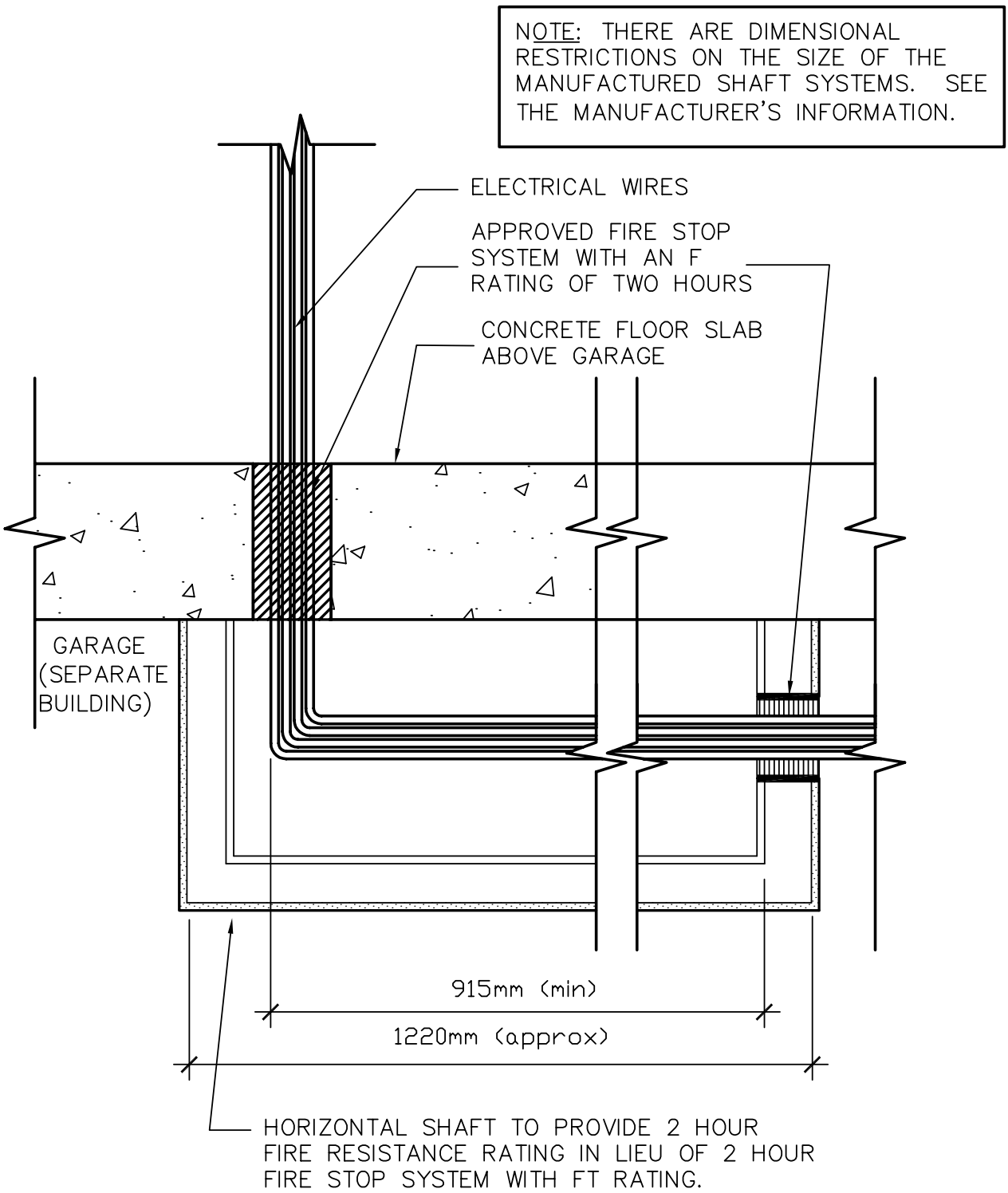
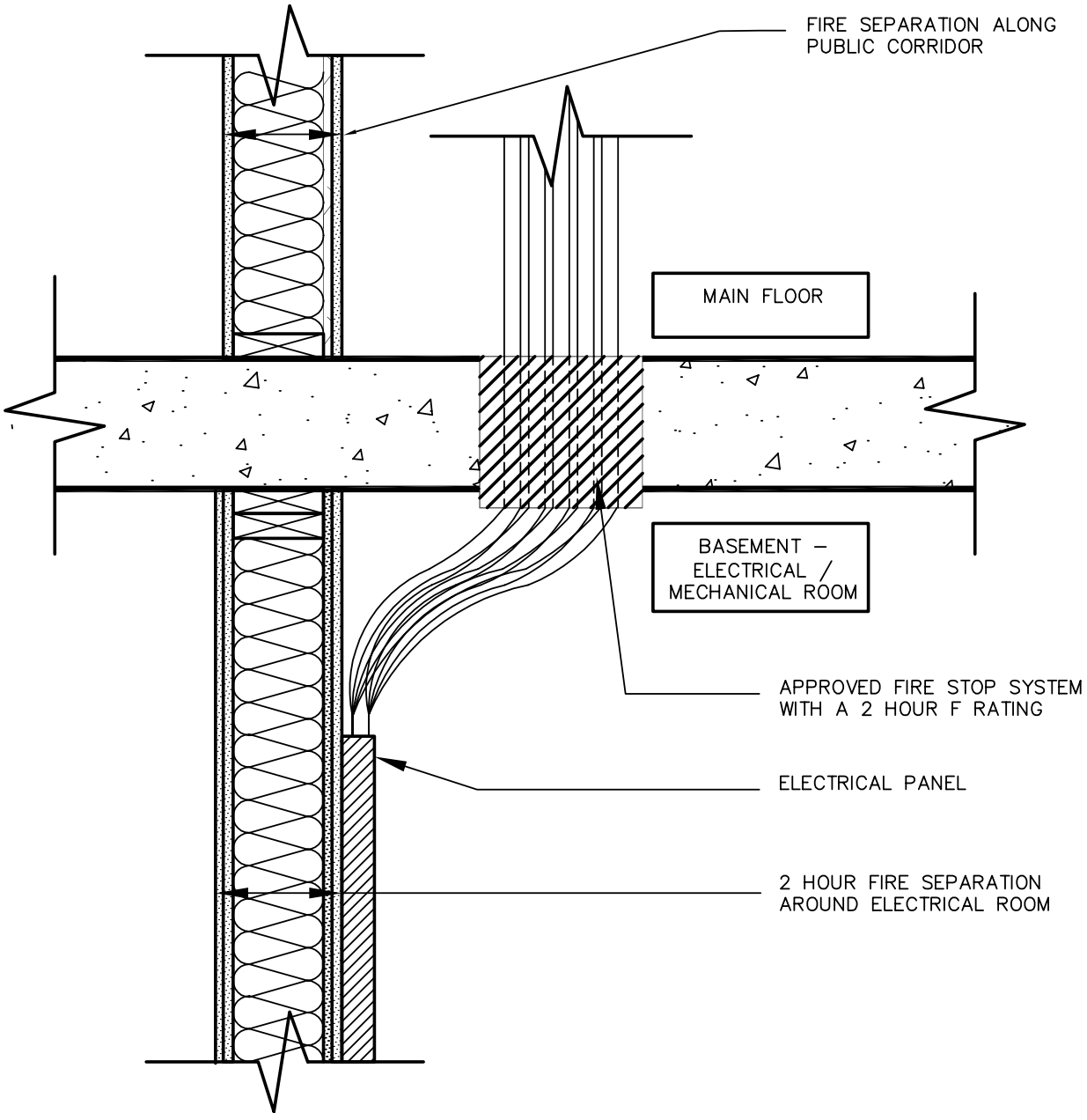


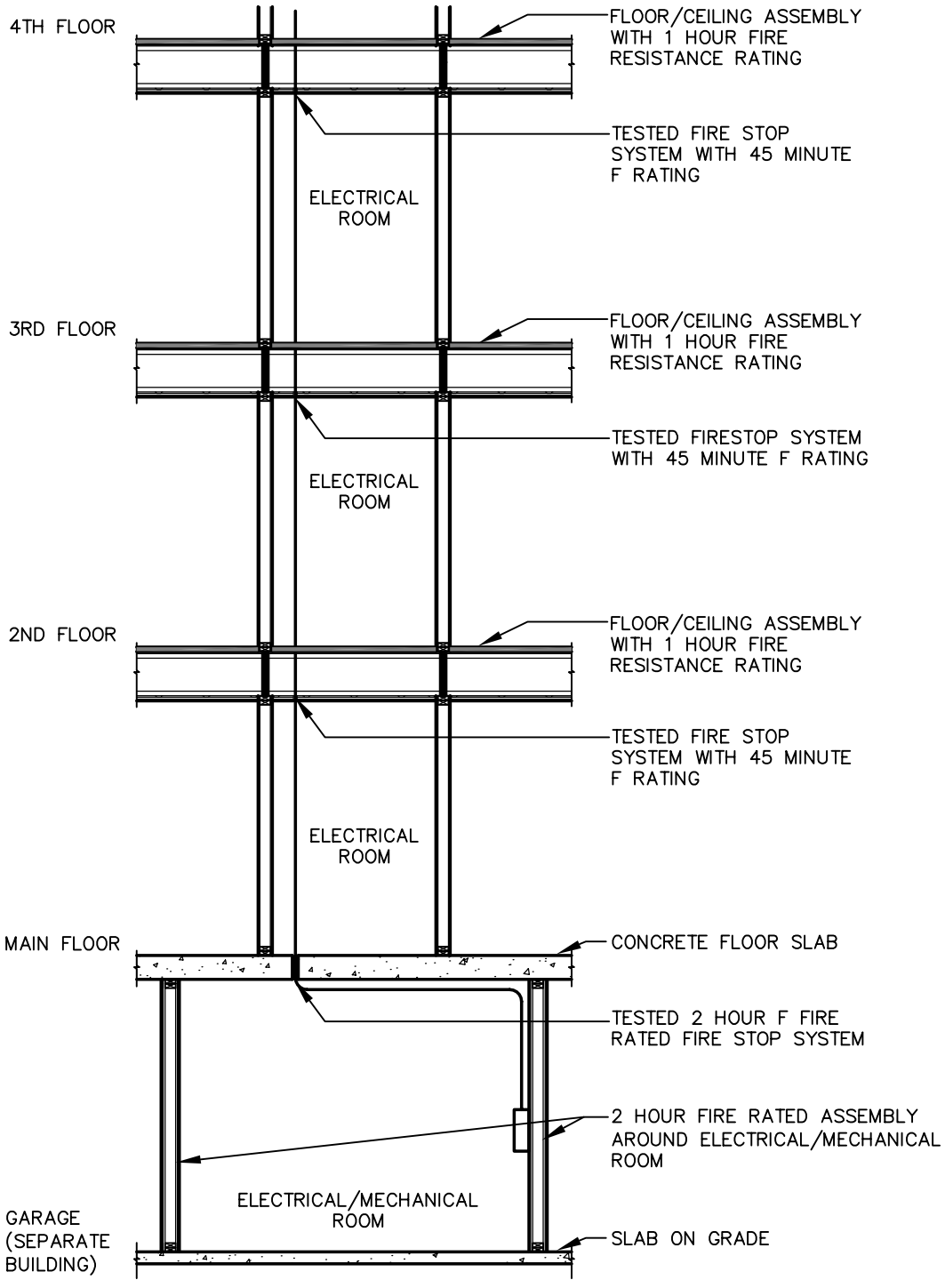
Wiring - Enclosed in a Shaft and Passing Through to the Main Floor Before Distribution

34



Wiring Distributed from the Basement Electrical Room - Equivalent to FT Rating

35



Stacked Electrical Rooms Above a Basement Electrical Room

Electrical Rooms

A common practice is to build a main electrical room in the basement of a building. If the basement garage is classified as a separate building and the wiring passes immediately out of this room to the other floors, you may want to upgrade the fire-resistance rating of this room to two hours to avoid having to achieve FT ratings where the wires pass through the slab between the garage and main floor. Electrical rooms are often stacked above this room on each floor, and they often have fire separations around them due to their location. They are often surrounded by fire separations between suites and public corridors. See the illustration of stacked electrical rooms in Figure 35.

Tested fire stopping systems need to be provided where all wiring enters or leaves electrical rooms. For bundles of wires up to 25 mm in diameter, you can follow the generic spacing requirements for grouped wires shown in Figure 36 and provide a manufacturer's test for the fire stop system or use a fire stop material that is compatible with the outside jacket of the wiring. For larger groups of wires, specify a manufacturer tested fire stop system that accommodates larger bundles.

Other Floors

General Information

The table outlines the maximum sizes of untested wires allowed as electrical penetrations. Please note that all penetrations still need to be sealed with a tested fire stop system using the manufacturer's installation instructions .

Wire Sizes, Wall Plate Sizes and Wire Spacings

Top and bottom plates can be completely riddled by wires passing through, if no pre-planning is done. To maintain structural strength of the wall, as well as giving a reasonable amount of space to install fire stop systems, wires or groups of wires should be spaced at least the same diameter apart as the larger adjoining wire or group of wires, unless you are using a fire stop system that allows multiple wires within the same space. In this case, follow the spacing shown by the manufacturer in the test. See the example of wire spacing in Figure 35.

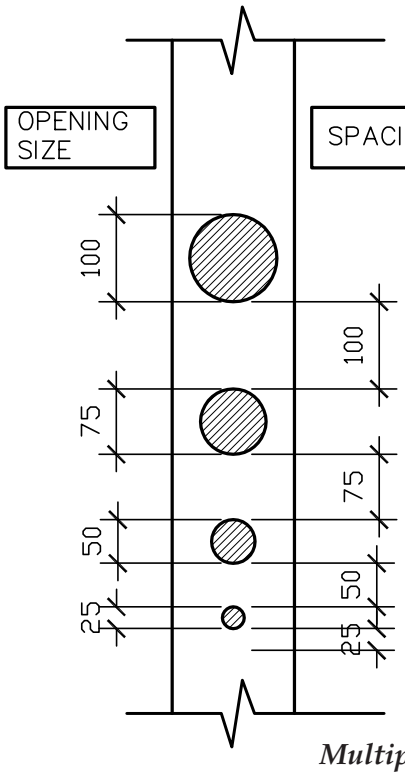
Type of Wire	Raceway or Insulation Jacket or Sheath	Maximum Size	Code Reference	FT 4 - Vertical Flame Test
Optical fibre cables, electrical wires and cables	Noncombustible	Any size	3.1.9.3.(1) 9.10.9.6.(3)	Not applicable
Optical fibre cables, electrical wires and cables	Combustible	25 mm (single or grouped)	3.1.9.3.(2) 9.10.9.6.(4)	For noncombustible buildings
Single conductor metal sheathed cable	Combustible	25 mm (single only)	3.1.9.3.(3)	For noncombustible buildings
Note: Wires must also have a minimum FT4 rating to allow their use in spaces used as return air plenums.				

When sleeves are used to pass wires through floors or walls, fire stopping is required for the space around the sleeve and the space around the wires where they enter and exit the sleeve. See the example in Figure 36 and see the manufacturer's test for details about the materials to use.

Also of concern is the width of the wall plates in relation to the wires passing through them. When larger wire bundles are running in a wall, larger wall plates should be used. Nominal wire sizes with diameters over 63.5 mm (2½ ") should be located in a minimum of 38 x 140 mm (2x6) walls. Keep in mind that in addition to the hole for the wire bundle, an annular space also needs to be provided into which to insert the fire stop system.

Group Wire Size	Size of Wall Plate
63.5 mm (2.5") or less (wire size)	38 x 89 mm
Over 63.5 mm (2.5" (wire size)	38 x 140 mm (or greater as required)

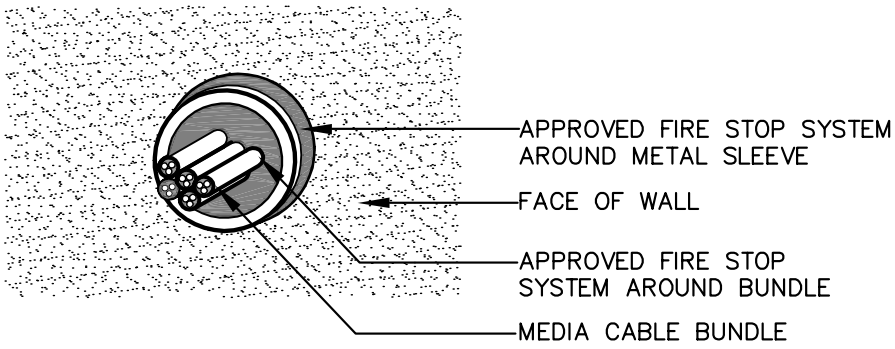
36



WALL PLATE SIZE	GROUP / WIRE SIZE
38 x 89 mm (2x4)	≤ 50 MM NOMINAL WIRE SIZE
38 x 140 mm (2x6)	> 50 MM NOMINAL WIRE SIZE

Multiple Wires - Plan View

37



Fire Stopping In and Around Metal Sleeves

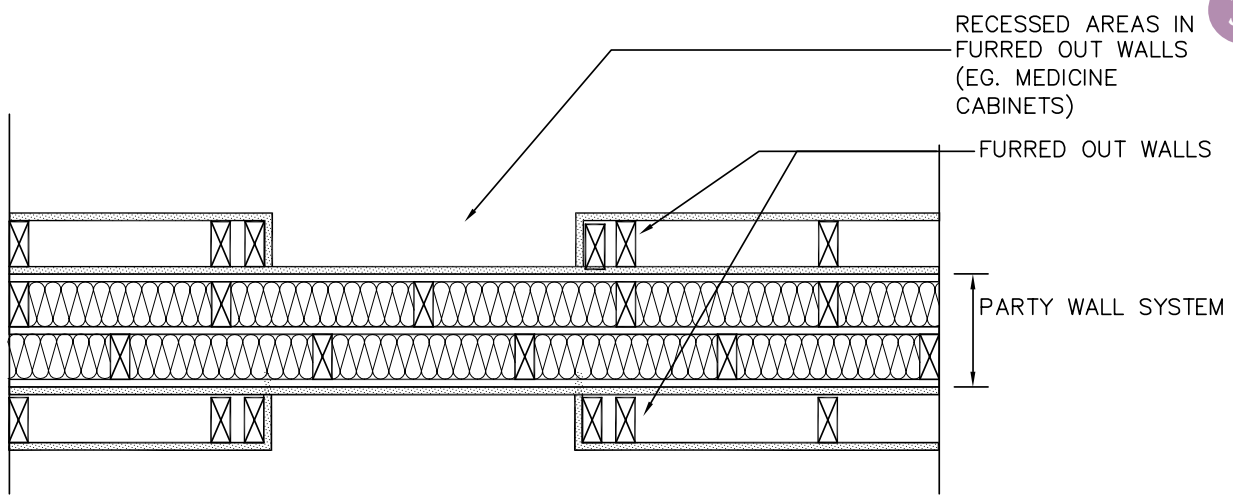
Electrical Panels

Locate electrical panels on interior walls.

If electrical panels are placed in a wall requiring a fire-resistance rating, there are a number of options:

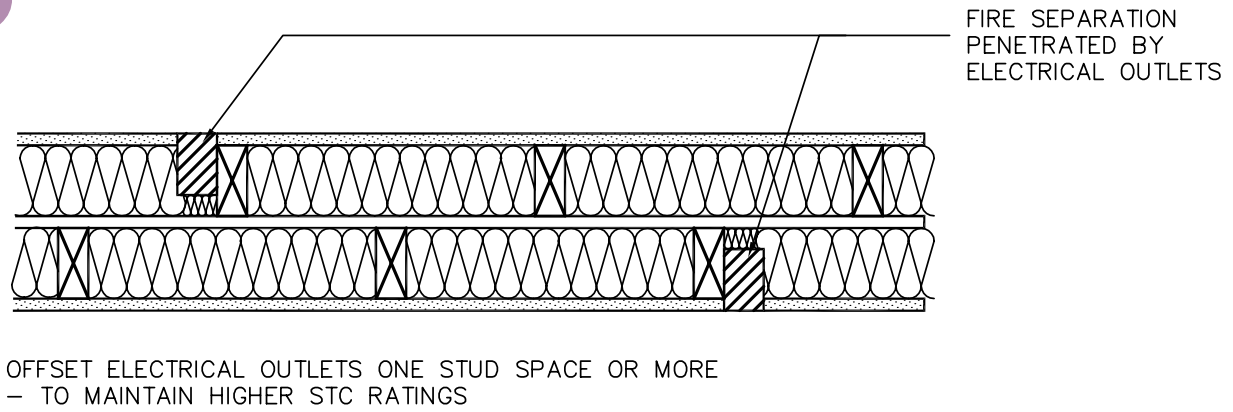
- Surface mount the electrical panel,
- Furr out a wall in front of a wall requiring a sound transmission and fire-resistance rating (see Figure 38), or
- Frame and install type X gypsum wallboard around the opening within the fire-rated assembly to maintain a fire-resistance rating for walls that require no sound transmission rating.

38



Electrical Opening Framed into Fire Resistance Rated Wall

39



Electrical Boxes Located More Than One Stud Space Apart

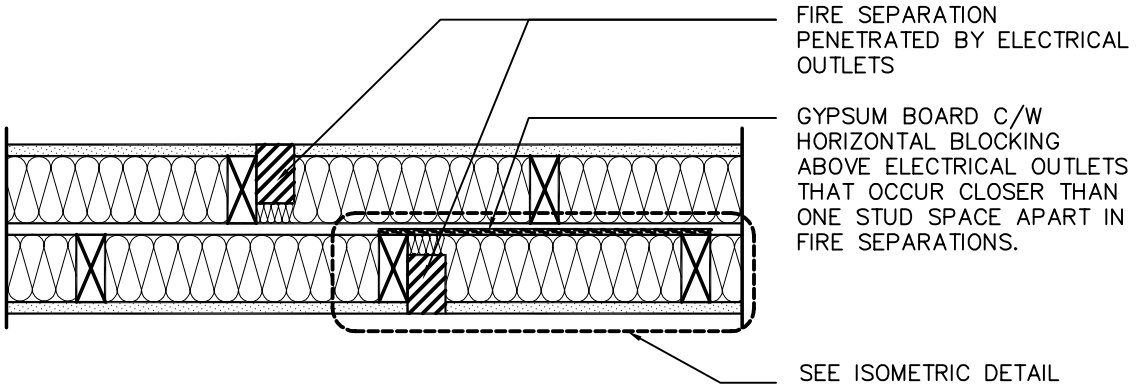
Electrical Outlet Boxes

Electrical outlet boxes may be placed in party walls (fire separations consisting of two walls with a 25 mm air gap between them); however they must be at least one stud space apart to meet fire separation integrity (Article 3.1.9.3.(6)) and sound transmission requirements (STC). For this reason, any electrical boxes in a party wall should be placed:

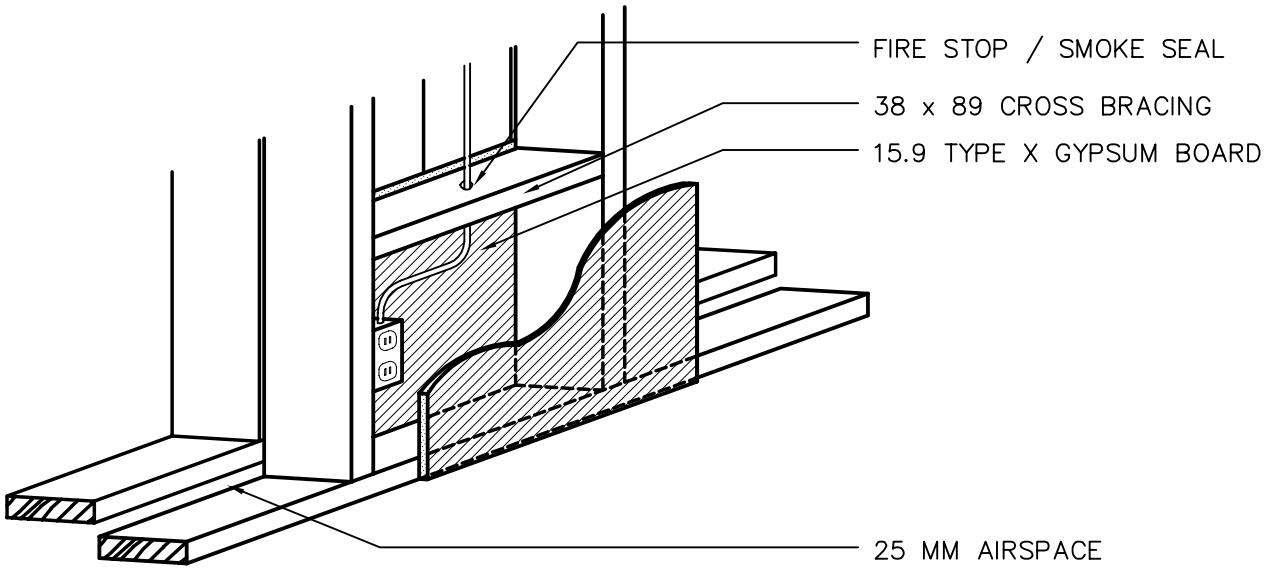
- At least one stud space apart (see Figure 39),
- If less than one stud space apart, install 15.9 mm (5/8") type X gypsum board backing with blocking across one stud space behind the box on one side of the separation (see Figure 40a and 40b),
- With appropriately labelled fire stop material around both the boxes, or
- In furred out walls.

Avoid placing outlet boxes too close together as STC ratings will be compromised.

40a

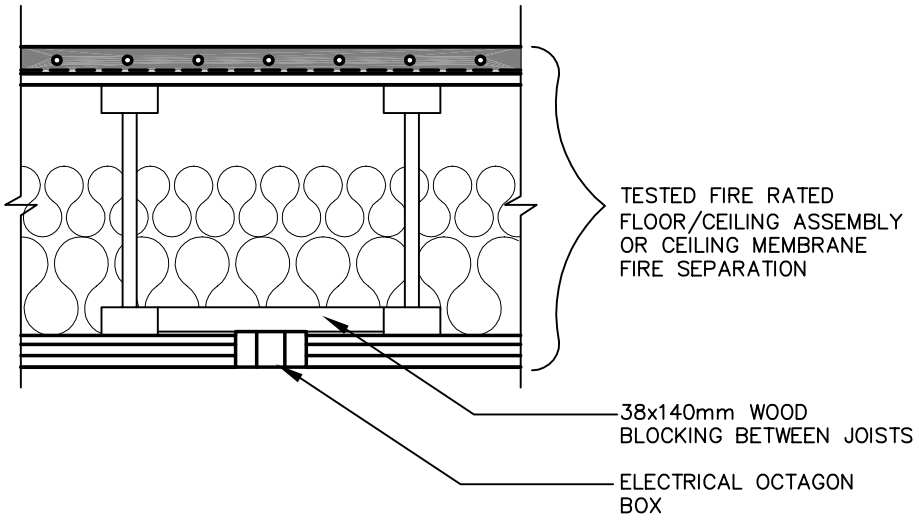


40b



Fire Stopping Where Boxes are Less Than One Stud Space Apart

41



Ceiling Outlet Box in a Fire Rated Assembly

Dryer and Range Receptacles

If dryer or range receptacles are inserted into a wall requiring a fire-resistance rating, there are a number of options:

- Surface mount the receptacle,
- Furr out a false wall in front of the wall requiring, a fire-resistance rating and STC rating ,
- Box around the receptacle with gypsum board for walls requiring a fire-resistance rating only, or
- Install the receptacle in a wall assembly that does not require a fire-resistance rating.

Bathroom and Kitchen Fans

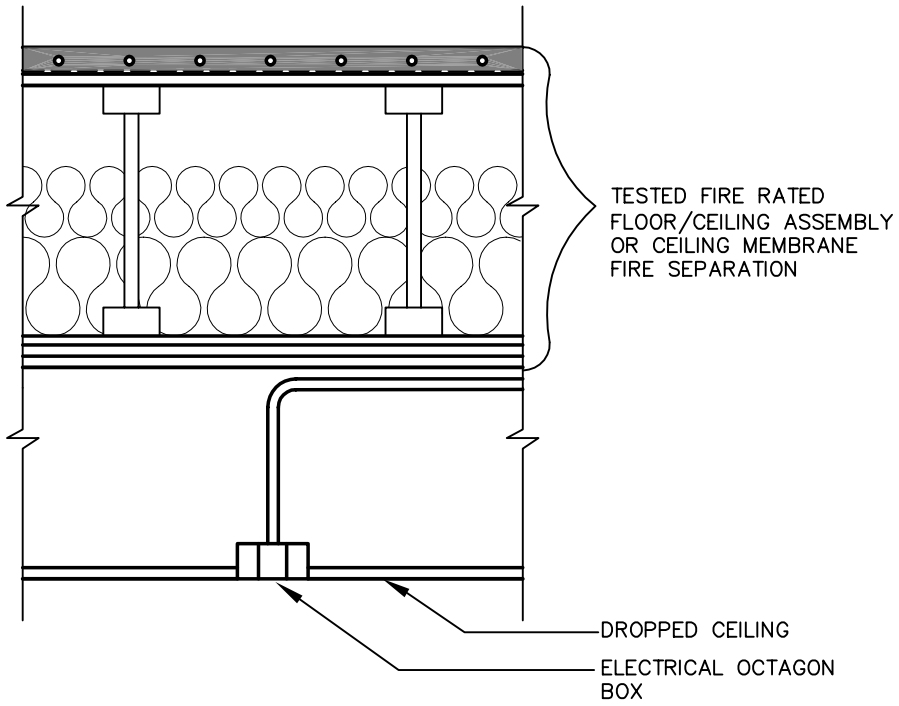
A few ways of installing kitchen and bathroom fans in an acceptable manner are:

- In unrated dropped ceilings below a floor assembly having a fire-resistance rating and STC rating,
- In furred out walls outside of walls required to have fire-resistance ratings and STC rating, or
- In rated floor assemblies by framing and installing type X gypsum board around the opening and ductwork within the fire rated assembly to maintain the fire-resistance rating and installing insulation above the fan and ductwork to help maintain the sound transmission rating.

Ceiling Outlet Boxes

For ceilings there are a number of possibilities. In all cases, keeping the services out of the ceilings is better for the sound transmission ratings of the assembly, however, small openings for octagon boxes are permitted.

42



Ceiling Fixture in a Dropped Ceiling Below a Fire Rated Assembly

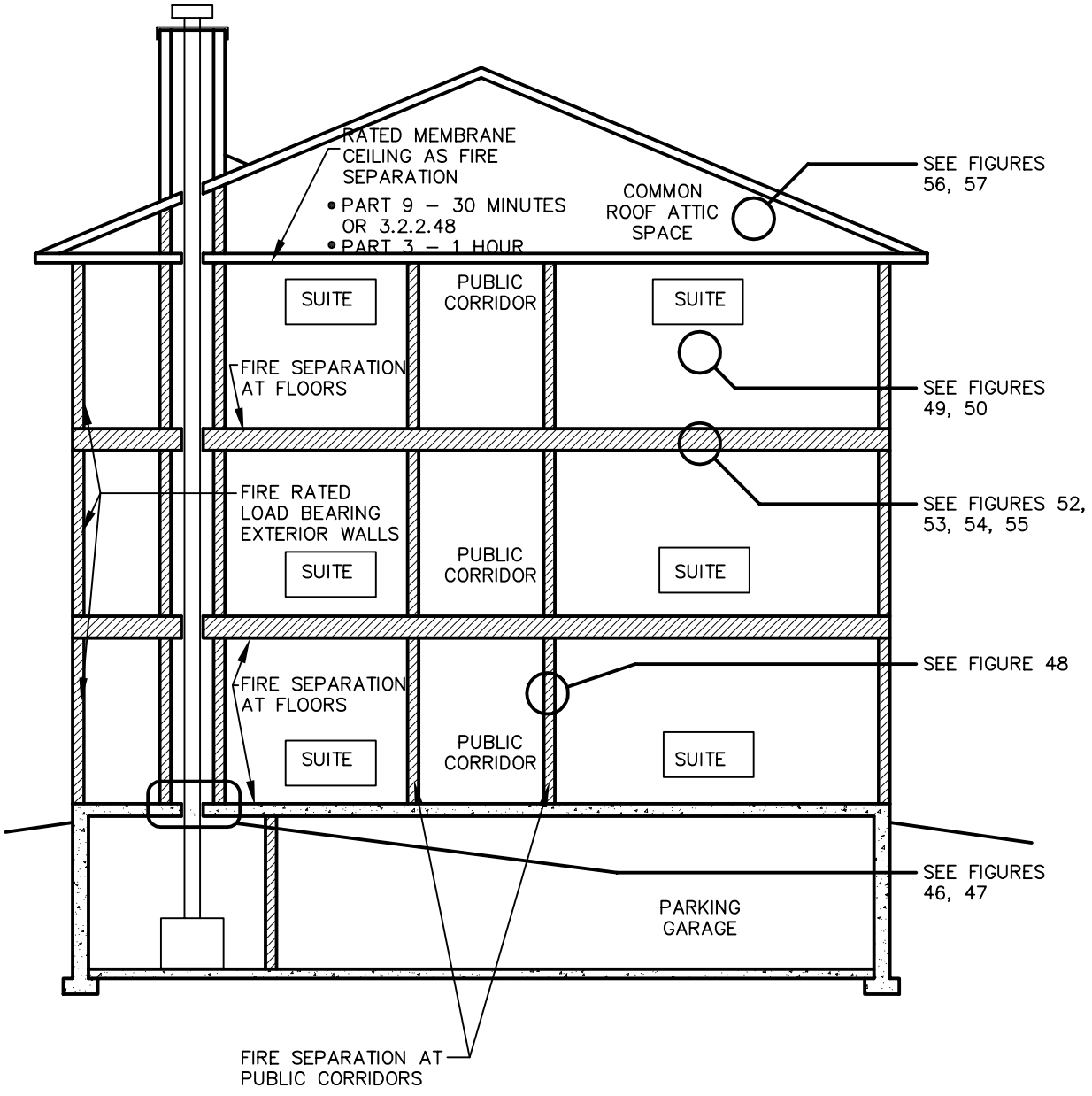
The options are:

- Install an octagon box directly into the floor assembly with a minimum of 38 x 140 mm blocking nailed to both structural members to form a fire stop above the octagon box (See Figure 41).
- Install the fixture in a dropped ceiling below the floor assembly. Where bathroom fans and other mechanical services require a dropped ceiling, this solution provides a better integrity for the fire separation and the sound transmission class rating (see Figure 42).

PART 2B - ELECTRICAL PENETRATIONS

PART 2C
MECHANICAL PENETRATIONS

43



Typical Building Showing Mechanical Services

Overview

Opposite is an illustration of a multi-family building showing various mechanical installations.

For smaller wood-frame, multi-family buildings, a number of different HVAC systems may be used to heat buildings. The most common choices are:

- Boilers with:
  ~ perimeter baseboards,
  ~ radiant floors, or
  ~ fan coil units
- Individual furnaces

For all of these options, air pressurization also needs to be provided into the corridors of multi-family buildings.

Fire stopping for gas and water piping associated with mechanical systems is outlined earlier in the piping section.

Duct work in individual suites is provided for:

- Bathroom fans
- Kitchen fans and
- Clothes dryers.

Two ways of installing these ducts in multi-family unit complexes are:

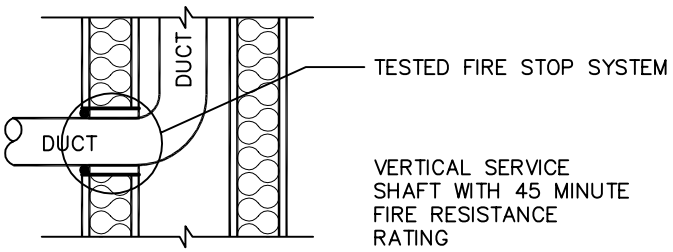
- Keep duct work within the dwelling unit and run it horizontally through the exterior wall, or
- Run the duct work within a vertical fire rated shaft.

These methods may or may not require the installation of fire dampers at each floor and wall penetration.

HOT TIP

Abandoned Openings
Sometimes a hole is cut in error and pipe, wire or mechanical equipment is not installed through the opening. When this occurs, close the opening using the same type of fire-resistive construction used to construct the original fire separation. Alternatively, a fire stop system tested for this purpose could be used to seal the opening.

44



Fire Stopping Around a Duct Which Does Not Require a Damper

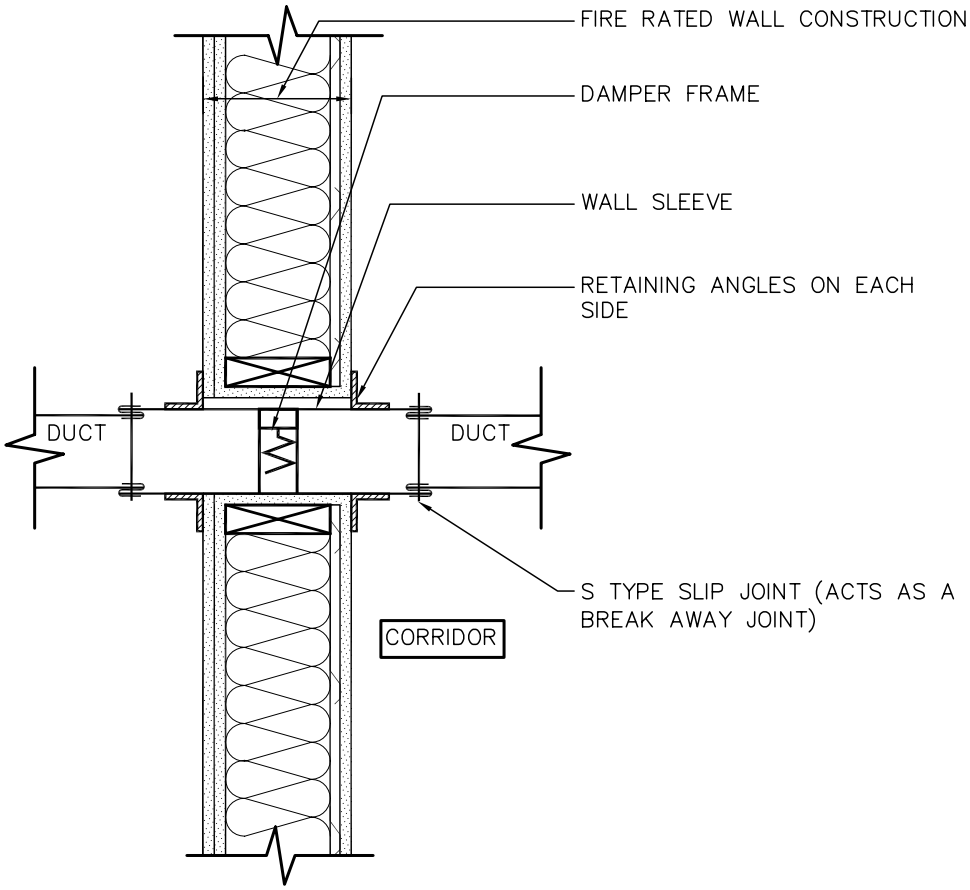
Ducts That Do Not Require Dampers

For ducts that do not require dampers, there are tested fire stop systems available. Generally, the fire stop system for these ducts consists of a fire stop caulk. See the example in Figure 44. Check manufacturer's listing for more information. For general information about fire stop systems see page 15.

Examples of the types of duct which may not require a damper are:

- Noncombustible kitchen and bathroom exhaust ducts (with fans) that penetrate a vertical service shaft. The exhaust duct runs continuously from the fan housing to the exterior of the building (Sentence 3.1.8.8.(4)).
- Noncombustible kitchen and bathroom exhaust ducts (without fans) that penetrate a common exhaust duct in a vertical service shaft. Where the duct enters the shaft, there is the option of either providing a fire damper or providing a 500 mm (20") upturn in the common exhaust duct (Sentence 3.1.8.8.(1)).
- Noncombustible ducts passing through a fire separation not required to have a fire-resistance rating (Sentences 3.1.8.8.(2) and (3)).
- Continuous steel ducts passing through vertical fire separations (walls) between suites, except in residential or care or detention occupancies (Sentence 3.1.8.8.(5)).

45



Typical Fire Damper in a Rated Wall Assembly

Ducts That Require Dampers

Ducts passing through fire separations and firewalls require fire dampers. To install a damper properly a number of elements and components need to be installed correctly. These elements include:

- Retaining angles,
- Clearances,
- Sleeve,
- Breakaway joints, and
- Approved fire damper.

Follow the manufacturer's installation instructions to install the damper correctly. See the example of a typical duct with fire damper passing through a wall in Figure 45.

Garages

The main consideration is whether the garage is part of the same building or a separate building. For piping requirements, see the section on piping. For ducts, these would either be fire dampered or enclosed in vertical shafts.

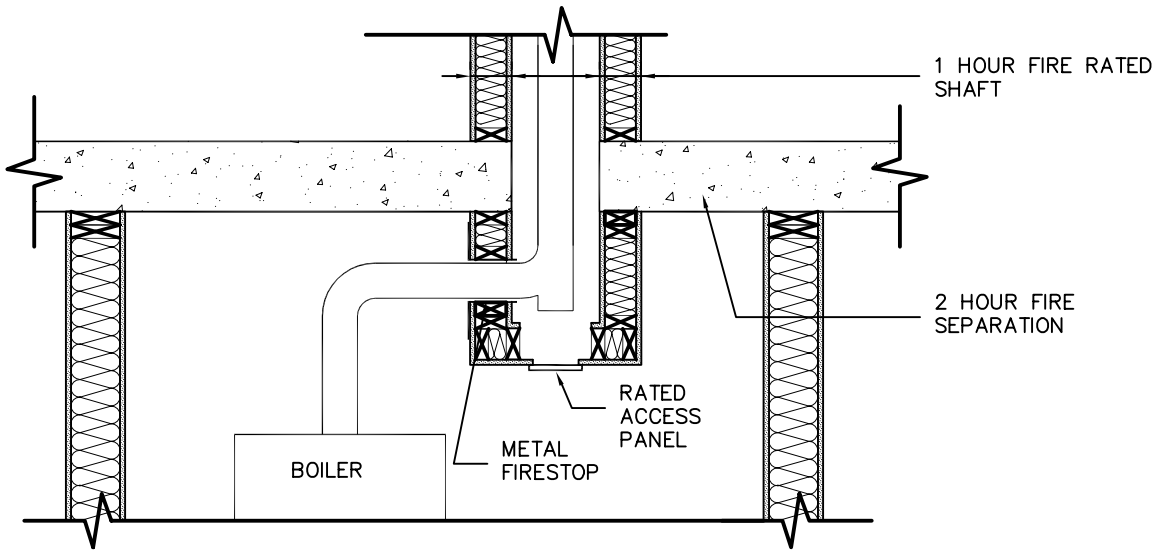
The fire separations required for the garage are shown in the table.

An alternative to enclosing the bottom of the shaft in a boiler room, is to upgrade the fire-resistance ratings of the walls around the boiler room and the shaft above to be equal to the rating of the garage floor assembly that they penetrate through.

A boiler room located in the basement would be rated for one or two hours depending on the type of occupancy and size of the building (Sentence 3.6.2.1.(1) and (2)). Because dampers cannot be used on chimneys, the chimney from the boiler requires a vertical shaft.

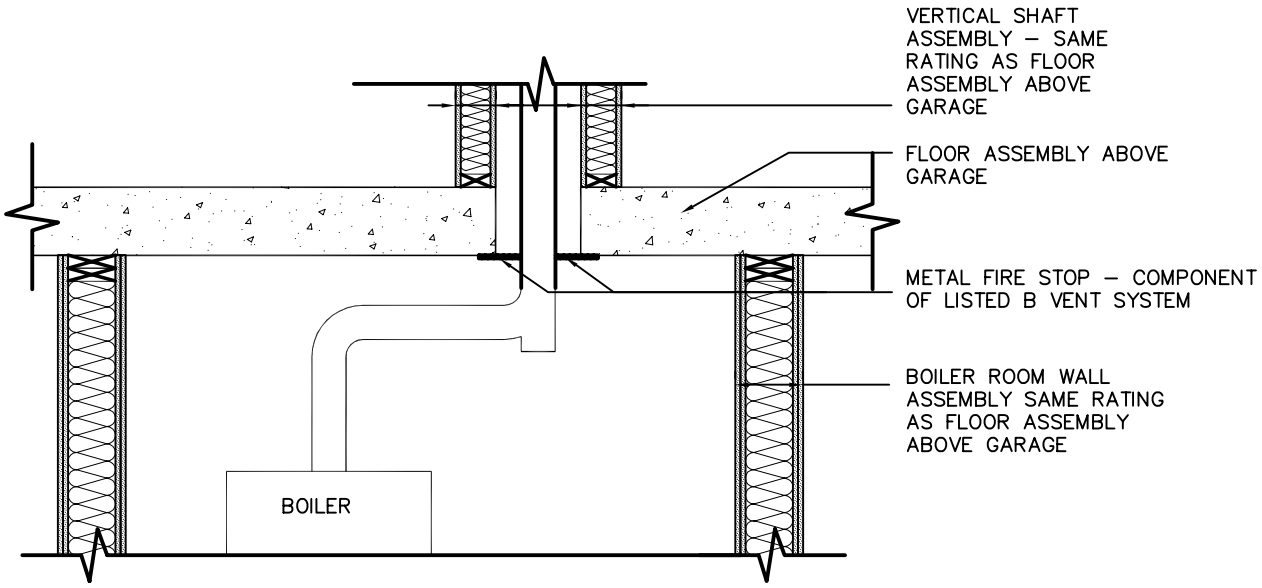
Garage	Fire Separation - Fire Resistance Rating Between Garage & Main Floor	Damper (Closure) Rating	Vertical Shaft Rating
Same building	1 ½ hour	1 hour	1 hour
Separate building	2 hour	1 ½ hour	1 hour
Note: Shafts that do not extend all the way to the bottom of a building are required to be enclosed at the lowest level with construction having the same fire-resistance rating. See Figure 46.			

46



Boiler in Garage - Bottom of Shaft Detail

47

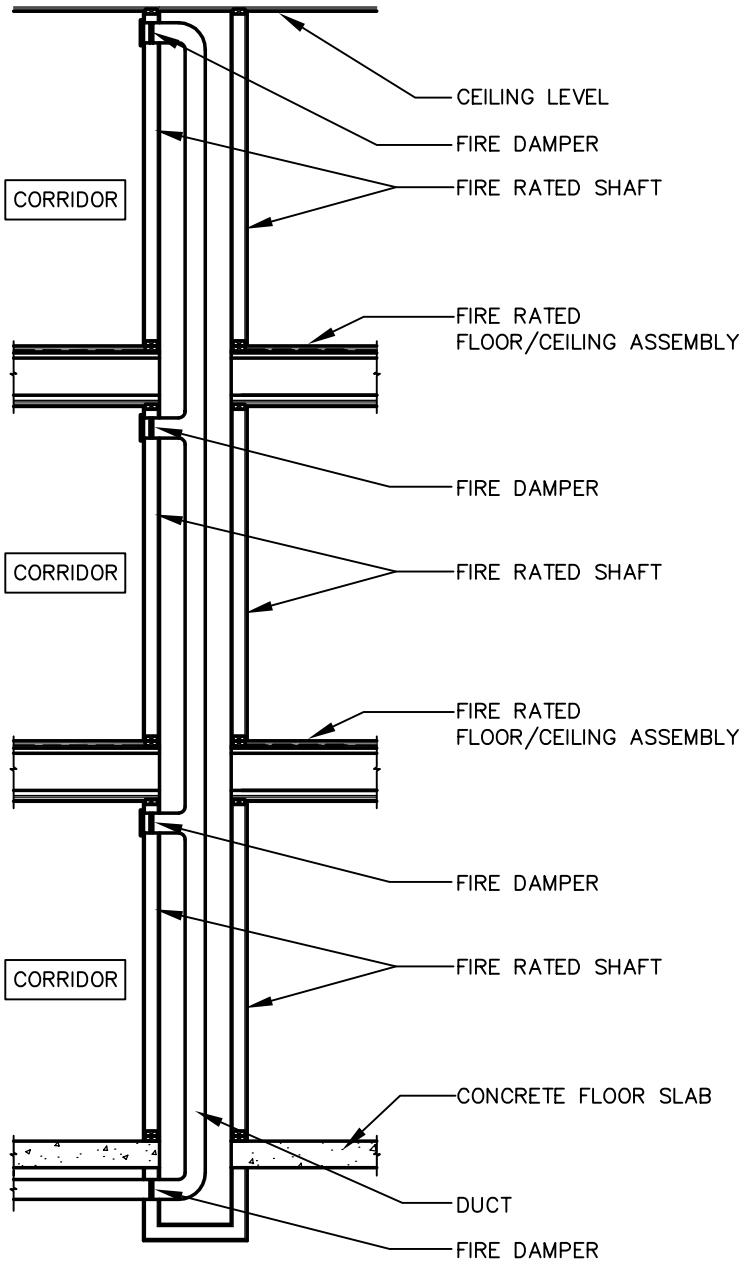


Boiler in Garage - No Bottom of Shaft Enclosure

Corridor Pressurization Units

There is sometimes confusion about separations and dampers required for corridor pressurization units. Normally the duct work for the corridor pressurization system is installed using a vertical shaft. Figure 48 shows a typical rated shaft with dampers at duct penetrations through the shaft wall.

48



Typical Corridor Pressurization Shaft

Ducts in Suites

Generally, ducts in multi-family buildings are associated with kitchen, bathroom or dryer exhaust. Occasionally, designers may use fan coil units or individual forced air furnaces to heat units.

Better choices for locating ducts without compromising fire separations and STC ratings include:

Walls

- Locate ducts in a furred out wall in front of the fire separation wall assembly requiring an STC rating (see Figure 49), or
- Locate ducts in interior walls within the suite (see Figure 50).

Floors

- Locate ducts in unrated ceilings or horizontal enclosures below the fire resistance rated floor assembly (see Figure 52).

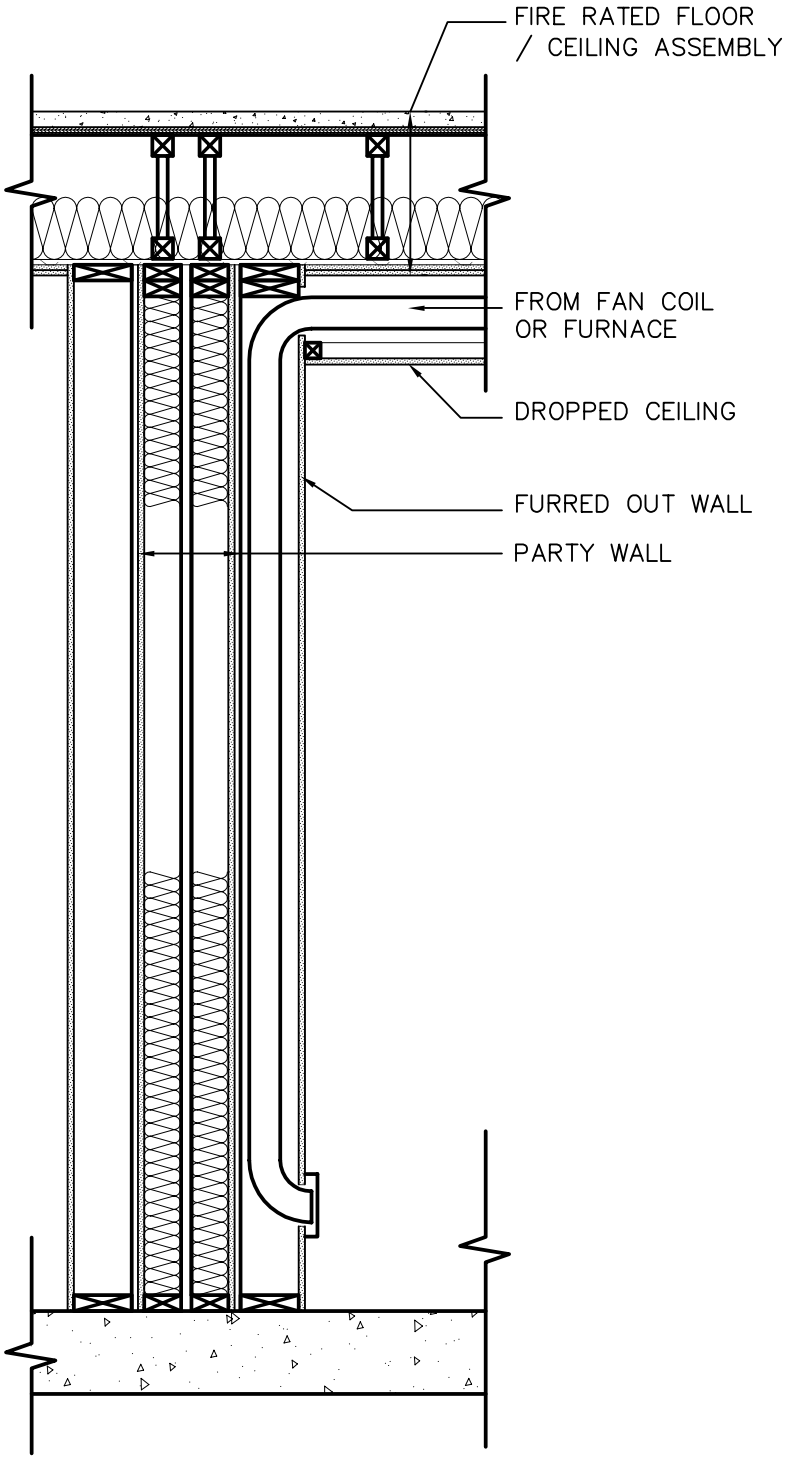
HOT TIP

Good Design for Duct Systems in Suites

One of the best ways to avoid noise being carried to other suites in a multi-family building is to keep all the duct work within the suite and exhaust it through the exterior walls.

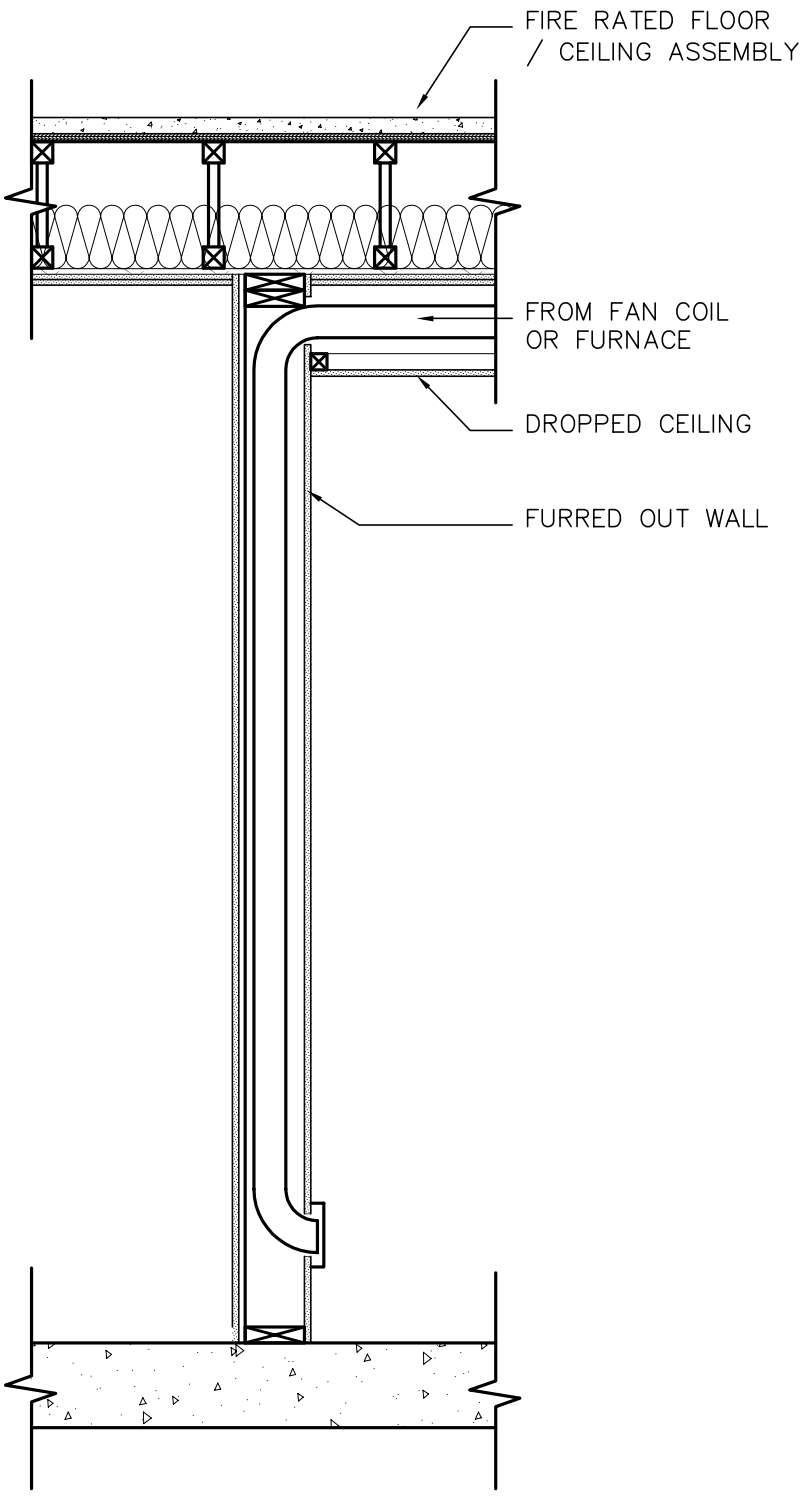
Another good method for ducts that have to pass through a number of floors in the building is to ensure those ducts are enclosed in a vertical shaft and separated from the suites by wall construction having an STC rating of at least 50.

49



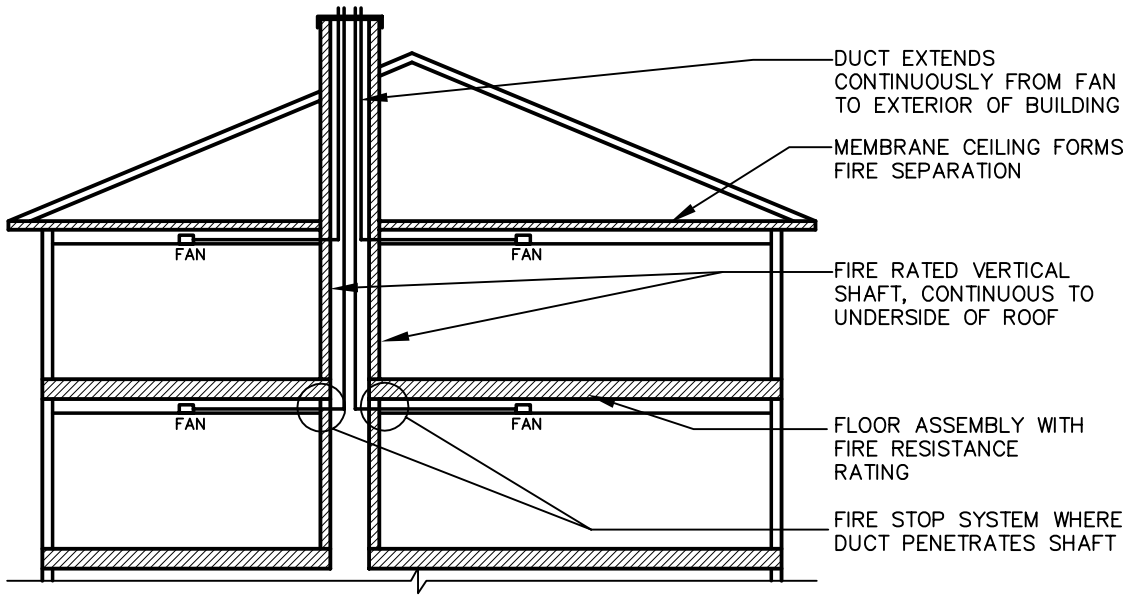
Air Duct in a Furred Out Wall

50



Air Duct in an Interior Wall

51



Bathroom and Kitchen Fans into a Vertical Service Shaft

Bathroom and Kitchen Fans

Three ways of dealing with these are:

- Install the exhaust duct into a vertical service shaft. The exhaust duct must be installed continuously from the fan to the exterior of the building. The fan needs to be adequately sized for this application. (See Figure 51.)

- Install the exhaust duct within the suite either within or below the fire rated floor/ceiling assembly to the exterior. Fan units should be installed below the actual assembly. (See Figures 52, 53 and 54.)

- In larger buildings, grills may be installed in kitchens/bathrooms and a continuously running fan unit is located at the top of the common exhaust duct within the shaft. Where the duct from the fan enters the shaft, it is either dampered or a 500 mm (20") upturn is provided (see Figure 55).

When fire-rated vertical service shafts are used and the duct is not dampered, the space around the duct should be sealed with a fire stop caulk where the duct penetrates into the vertical shaft. Check the manufacturer's listing for specific fire stop systems.

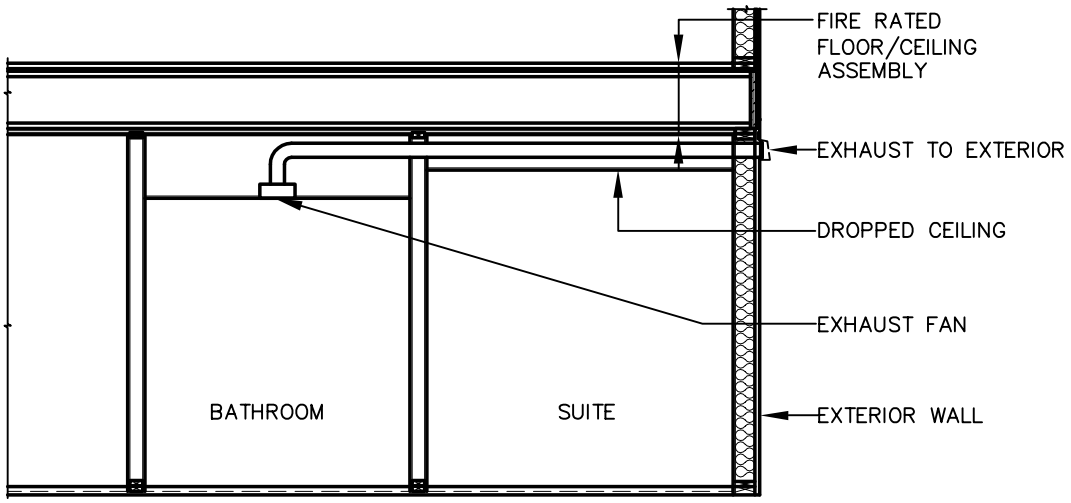
When the vertical fire-rated shaft reaches the uppermost storey of a multi-family unit, either:

- Extend the shaft to the underside of the roof sheathing (see Figure 56),

- Provide a damper for the duct at the ceiling level (see Figure 57), or

- Wrap the duct above the ceiling membrane with a listed, fire-rated duct wrap material.

52



Typical Duct Running Through a Horizontal Chase to the Outside of the Building from Within the Suite

HOT TIP

Combustible Ducts are Okay for Bathroom Exhaust Fans

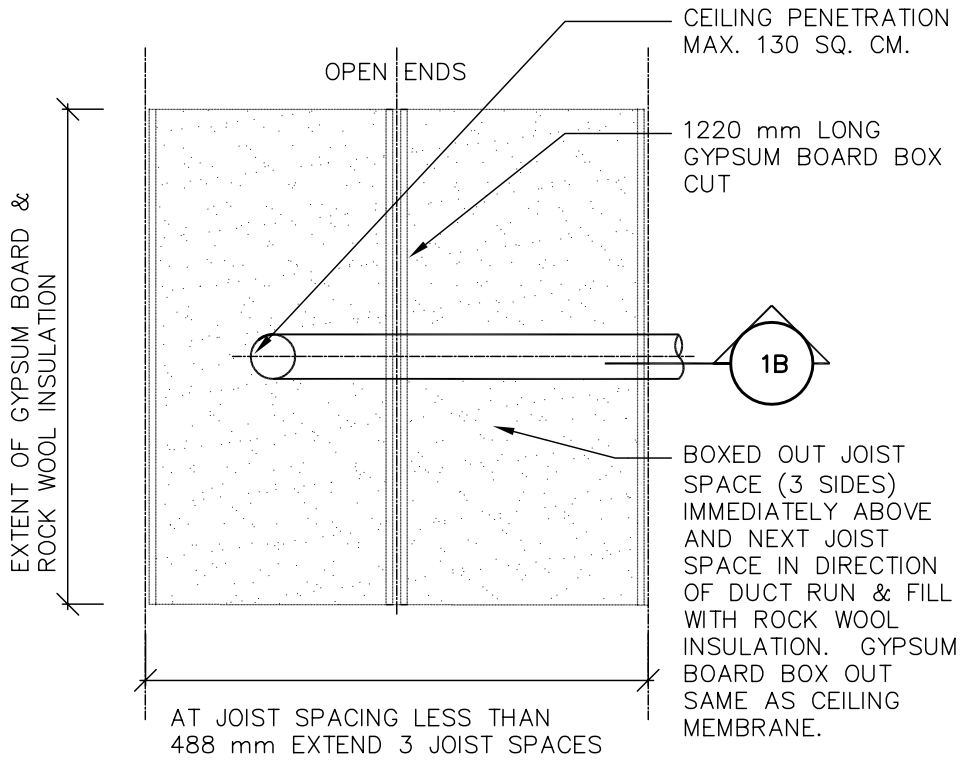
Combustible ducts may be used within a suite for bathroom exhaust fans, provided the duct is Class 1 and meets the other requirements of Sentence 3.6.5.1.(2) or Article 9.33.6.2. If the duct penetrates a fire separation, it needs to be noncombustible.

Standata 97-DR-023 - Washroom and Kitchen Exhaust Ductwork in Residential Occupancies of Combustible Construction

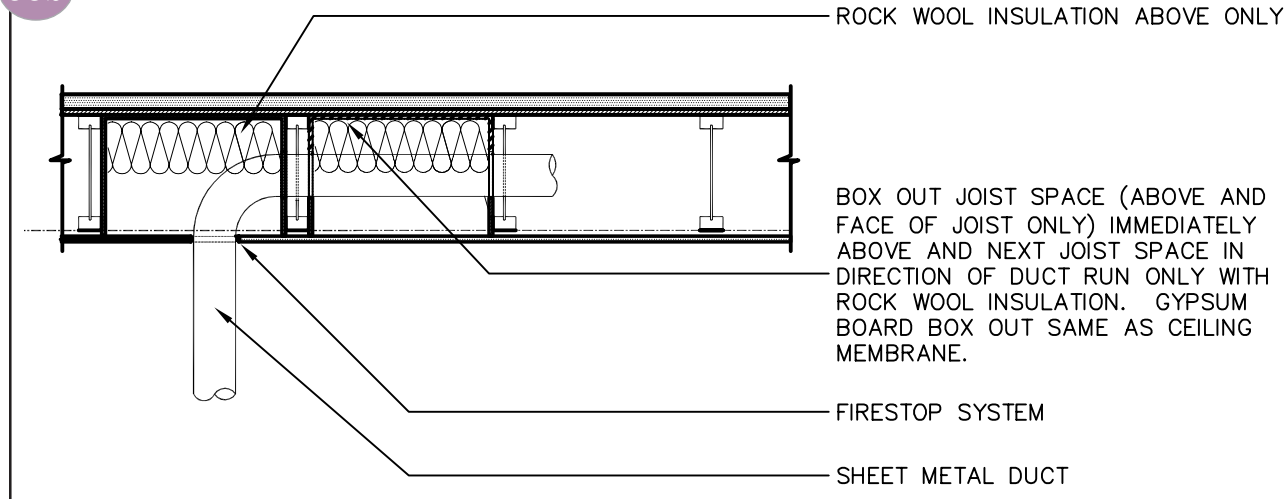
A Standata exists which allows different solutions than shown here for combustible construction up to four storey with no basement or three storey with basement. The Standata was written during an era when fire separations between suites and between suites and public corridors extended to the underside of the roof deck in the attic. Common practice now is to use a membrane ceiling at the top floor level, allowing larger concealed spaces in the attics. The Standata is available for use; however, we caution users that it should not be used when membrane ceilings are used as the fire separation at the upper floor level.

In addition, designers may find there are sound issues involved in installing multiple ducts in small stud spaces.

53a

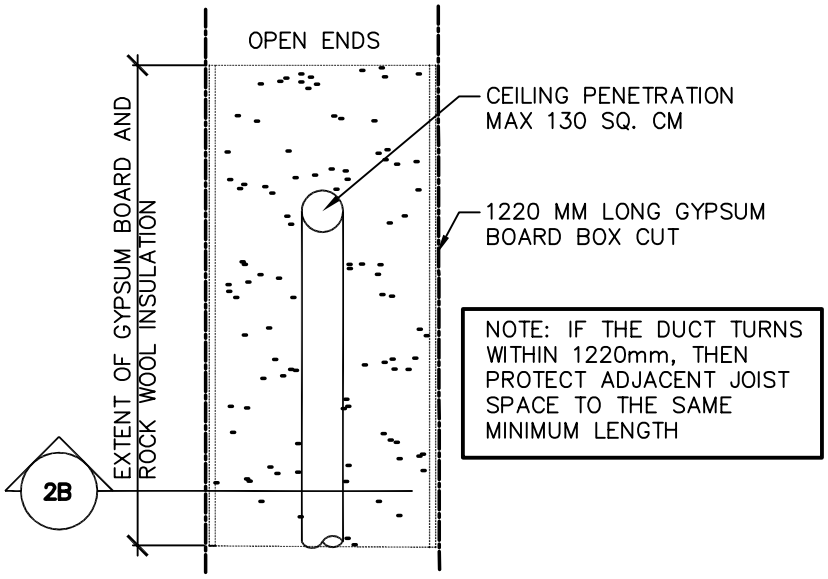


53b

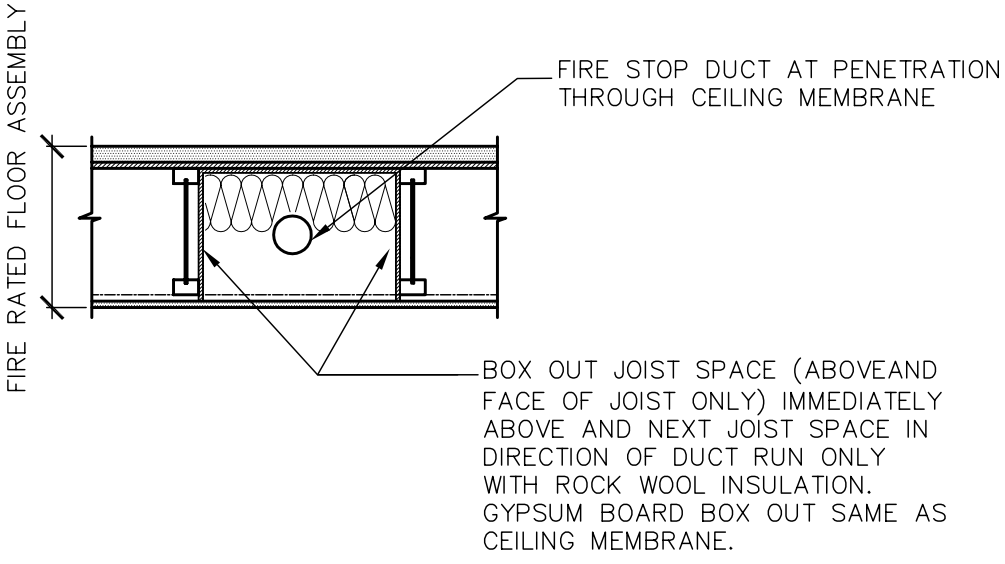


Typical Duct Running Perpendicular to Joists Within a Floor Assembly to the Outside of the Building from Within the Suite (The City of Calgary Interpretation - January 28, 1999)

54a

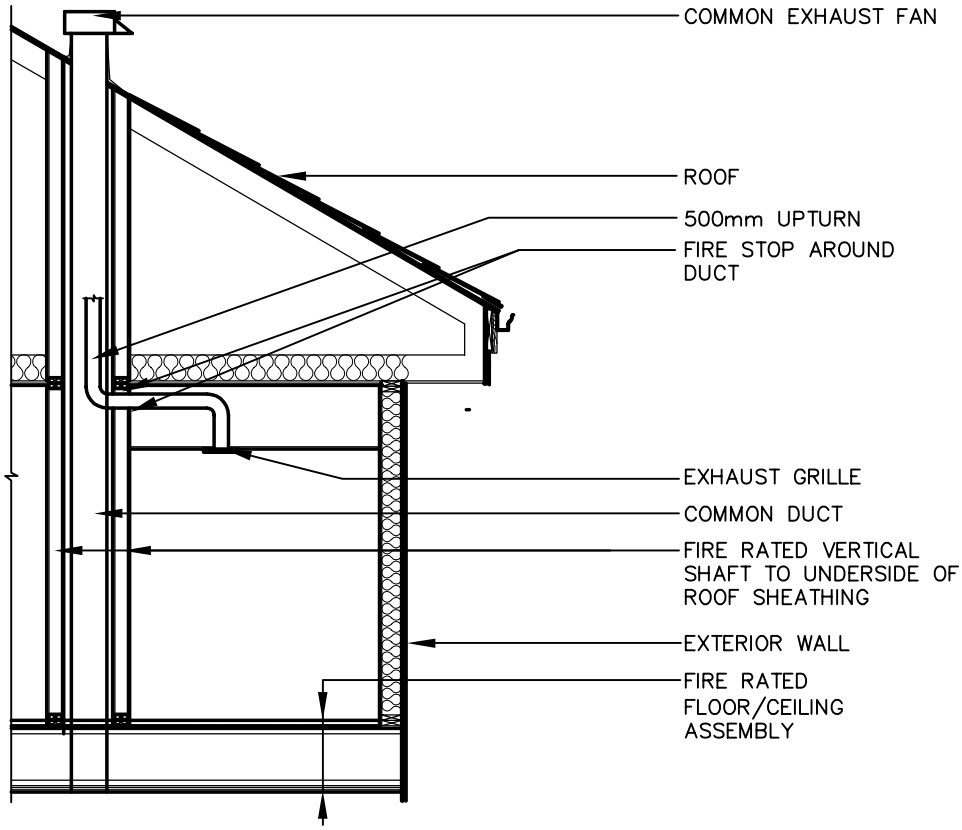


54b



Typical Duct Running Parallel to Joists Within a Floor Assembly to the Outside of the Building from Within the Suite (The City of Calgary Interpretation - January 28, 1999)

55



Vertical Service Shaft With a Fan Unit at the Top

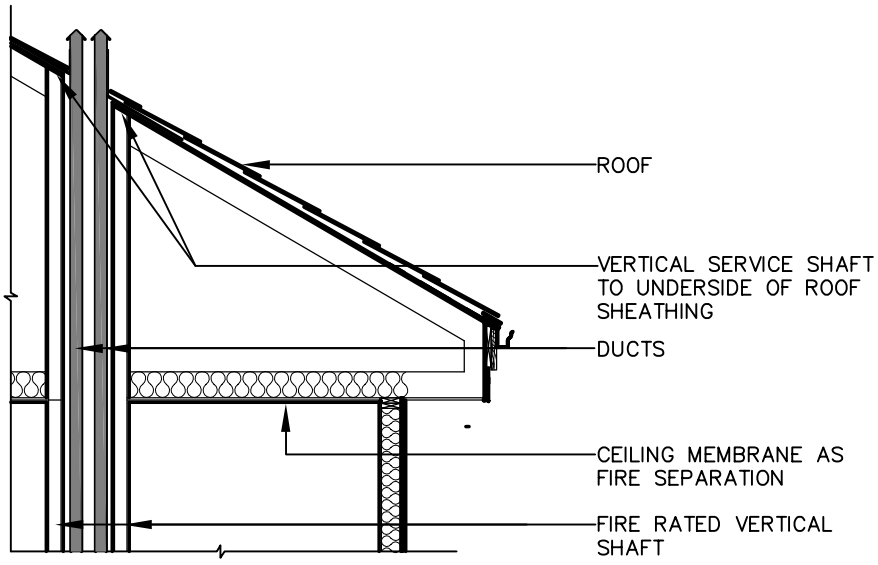
Dryer Ducts

Many multi-family developments now provide laundry rooms with washers and dryers in each unit. The following characteristics are unique to dryer vents:

- They carry hot air and lint that is a flammable material.
- Fire dampers cannot be used because they trap lint.
- Noncombustible steel duct is required all the way (melting point above 760°C).
- The length of the dryer exhaust is limited by the dryer manufacturer.

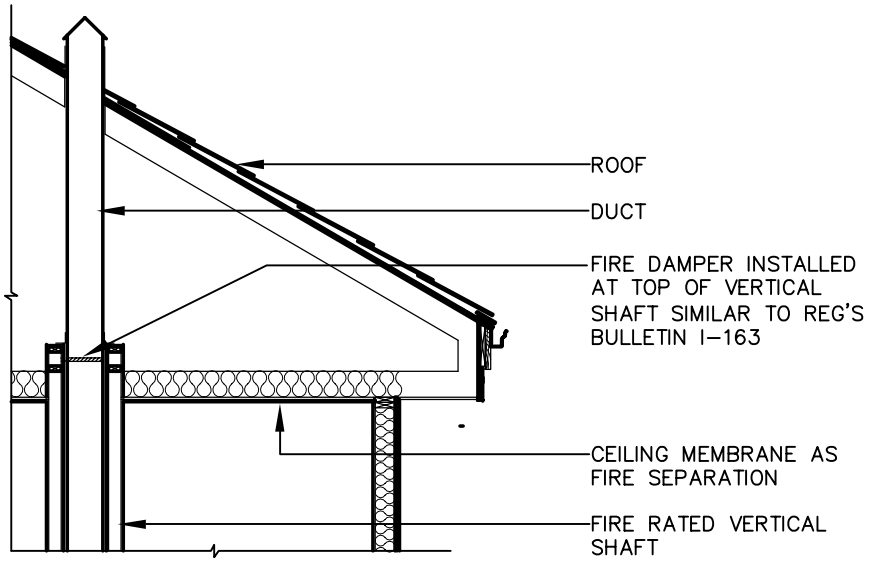
Because of these factors, dryer exhausts need to be run directly outdoors from the unit they are located in; similar to Figures 52, 53a/b or 54a/b.

56



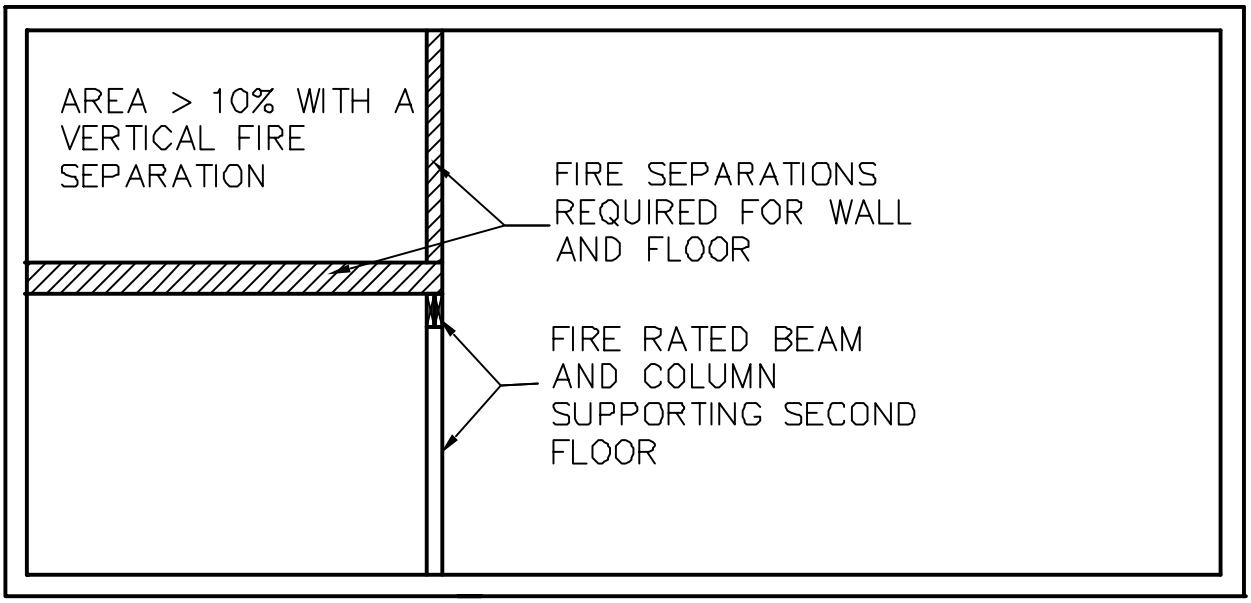
Shaft Extending to Underside of the Roof Sheathing

57

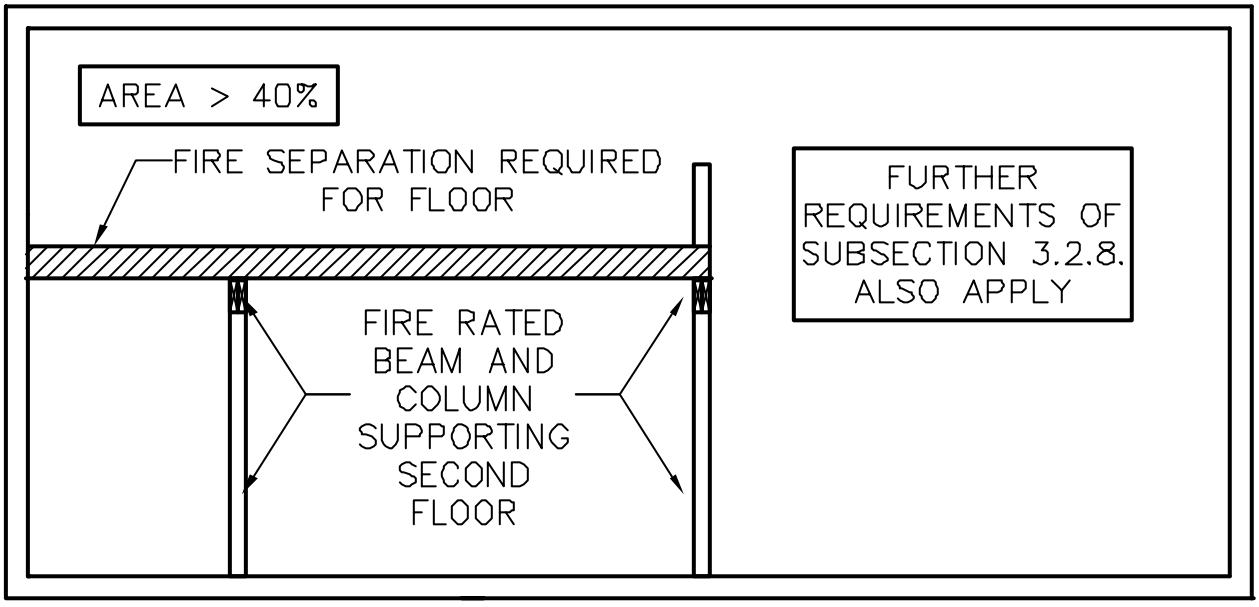


Ducts Dampered at the Membrane Ceiling Level

58a

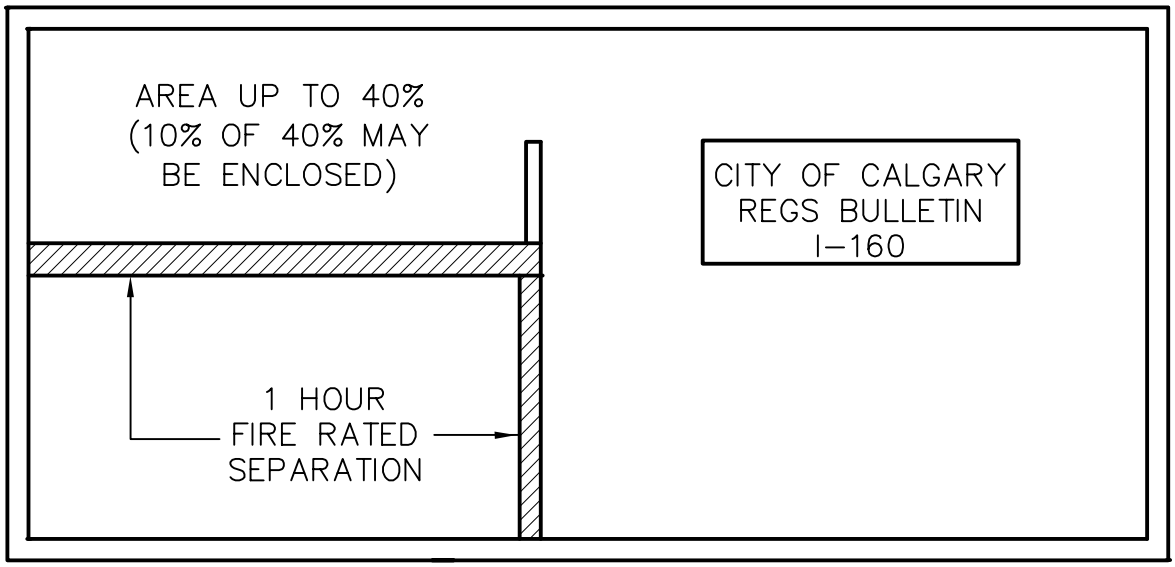


58b



Mezzanine as a Second Storey

59



Mezzanine With Enclosed Lower Floor

Second Storey or Mezzanine Floor Fire Separations

There is often misinterpretation about what is considered a second storey in a building and when this space is considered a mezzanine (Articles 3.2.82 and 9.10.4.1). For a second storey, a wood-frame floor assembly is constructed as a fire separation and fire dampers are required. Two common scenarios when a second storey floor may be mistaken for a mezzanine are:

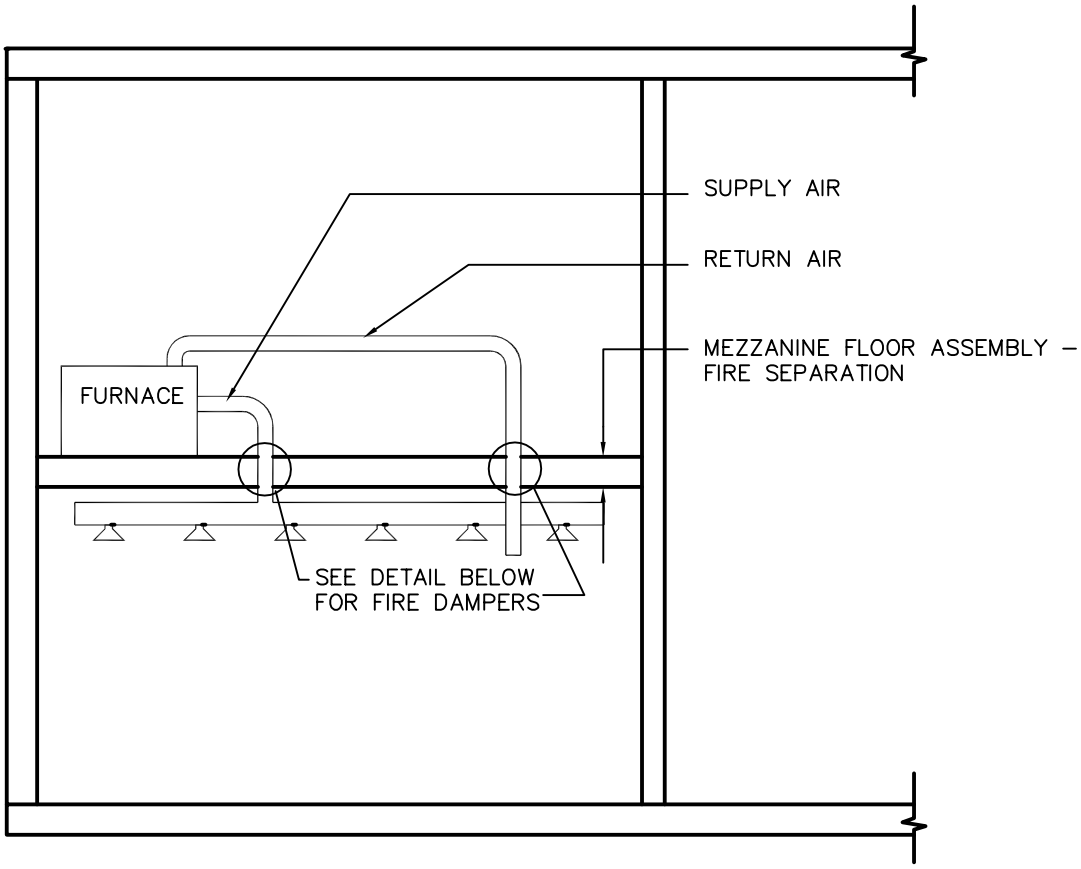
- If the upper floor area is over 10% of the floor area and is enclosed, a vertical and horizontal fire separation is required. (See Figure 58a.)

- If the upper floor area is over 40% of the floor area and not enclosed with a vertical fire separation, the floor assembly must be constructed as a fire separation and the additional requirements of Section 3.2.8 for interconnected floors also apply. (See Figure 58b.)

The City of Calgary also has a *Regs Bulletin* (I-160) which allows the enclosure of a lower level under a mezzanine with a wall and floor assembly constructed as a one-hour fire separation, in lieu of providing visual access for the lower floor. (See Figure 59).

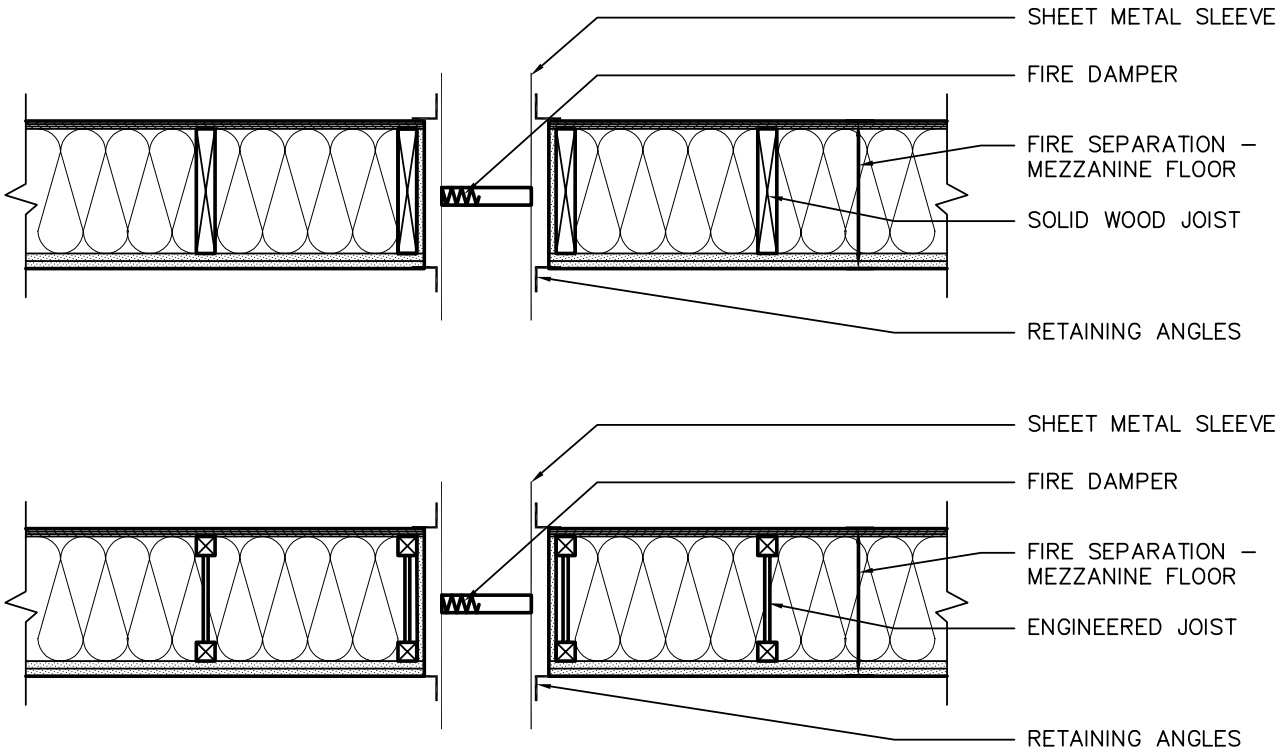
In these cases and any other cases where a wood-frame floor assembly is constructed as a fire separation, a fire damper is required where mechanical ducts pass through the floor assembly. (See Figures 60 and 61.)

60



Duct Passing Through a Floor Where a Fire Separation is Required

61



Detail - Fire Damper Through Floor

Part 2C - Mechanical Penetrations

Part 3
Fire Stopping in Noncombustible Buildings

(Material unavailable at this time.)