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The course you are about to take focuses on the technical aspects of the text of Part 3 of the Ontario Building Code (Building Code or Code) and some of its principal referenced documents. It is designed to assist building officials / designers in obtaining Code compliance, to ensure the safety of occupants of buildings.

This *Part 3: Fire Protection* course will review Part 3 of Division B of the Code relating to Fire Protection. It will not deal with Sections 3.9. (Portable Classrooms), 3.10. (Self-Service Storage Buildings), 3.11. (Public Pools), 3.12. (Public Spas), 3.13. (Rapid Transit Stations), 3.14. (Tents and Air-Supported Structures), 3.15. (Signs), 3.16. (Shelf and Rack Storage Systems) and 3.17. (Additional Requirements for Existing Buildings).

Note: Unless otherwise stated, all references are with respect to Division B of the Building Code.

COURSE FORMAT

The course is organized into a number of modules. The first module will consist of a general introduction to the course, as well as a formal introduction by the participants and the facilitator(s).

You are asked not to read ahead unless directed to do so by the facilitator. Your input on course content will be collected during the course evaluation session. Your comments are important; they enable the Building and Development Branch to keep the course current to your needs. For this reason, as we go through the course, go to the last module and insert your comments, not only on course content but also on the facilities where the course is being held.

THE PURPOSE OF THE EXERCISES

Every module is broken down into a number of exercises. Each exercise is designed to deal with a specific topic/Code principle and incorporates activities that will assist you to:

- Understand the rationale underlying the Code's requirements,

firefighters. This is evidenced by Sentence (2) of Articles 3.2.2.20. to 3.2.2.83. These Sentences inform us which *buildings* are permitted to be of *combustible construction*, and which ones are required to be of *noncombustible construction*.

Generally speaking, when a *building* is permitted to be of *combustible construction*, it is permitted to be constructed of the *combustible* materials, with or without *noncombustible components*.

If a *building* required to be of *noncombustible construction* contains *combustible* components **not** specifically permitted by Article 3.1.5.1., the *building* falls within the category of *combustible construction*.

When a *building* is required to be of *noncombustible construction*, the materials, assembly of materials, and structural members are required to be of *noncombustible construction* except as permitted by Articles 3.1.5.1. to 3.1.5.26., 3.1.13.4. (Light Diffusers and Lenses), and 3.2.2.16. (Heavy Timber Roof Permitted).

According to Article 3.1.5.1. *Combustible* materials are permitted to be used in buildings of *noncombustible construction* when the material is tested in accordance with CAN/ULC-S135, "Test Method for the Determination of Combustibility Parameters of Building Materials Using an Oxygen Consumption Calorimeter (Cone Calorimeter)", using the test and acceptance criteria outlined in Sentences 3.1.5.1.(2) through (4).

In the next exercise, we will consider how to differentiate *combustible* materials from those that are *noncombustible*. In most instances, common sense and experience will dictate whether building materials should be classified as *combustible* or *noncombustible*.

Exercise #1

Noncombustibility of building materials is discussed in Supplementary Standard SB-2, "Fire Performance Ratings", Section 4.

Take 10 minutes to read the documentation from SB-2; it has been reproduced here for your convenience. Then, take an additional 10 minutes to identify the materials listed as *combustible* or *noncombustible*. For each item state whether or not the item is *combustible* or *noncombustible*. Do not refer to the Building Code,

use your intuition. Discuss your answers with your group. Class discussion will follow.

Supplementary Standard

SB-2, Section 4 Noncombustibility

4.1. Test Method

4.1.1. Determination of Noncombustibility

(1) Noncombustibility is required of certain components of buildings by the provisions of this Code, which specifies noncombustibility by reference to CAN/ULC-S114, "Test for Determination of Non-Combustibility in Building Materials".

(2) The test to which reference is made in Sentence (1) is severe, and it may be assumed that any building material containing even a small proportion of combustibles will itself be classified as combustible. The specimen, 38 mm by 51 mm, is exposed to a temperature of 750°C in a small furnace. The essential criteria for noncombustibility are that the specimen does not flame or contribute to temperature rise.

4.2. Materials Classified as Combustible

4.2.1. Combustible Materials

(1) Most materials from animal or vegetable sources will be classed as combustible by CAN/UlC-S114, "Test for Determination of Non-Combustibility in Building Materials" and wood, wood fibreboard, paper, felt made from animal or vegetable fibres, cork, plastics, asphalt and pitch would therefore be classed as combustible.

4.2.2. Composite Materials

(1) Materials that consist of combustible and noncombustible elements in combination will in many cases also be classed as combustible, unless the proportion of combustibles is very small. Some mineral wool insulations with combustible binder, cinder concrete, cement and wood chips and wood-fibred gypsum plaster would also be classed as combustible.

4.2.3. Effect of Chemical Additives

(1) The addition of a fire-retardant chemical is not sufficient to change a combustible product to a noncombustible product.

2. Imagine that the product in Question #1 is tested. The results indicate that it **failed** to meet the acceptance criteria of CAN/ULC-S114, "Test for Determination of Non-Combustibility in Building Materials".

   a) What action would a CBO take to ensure Code compliance?

3. Are *combustible* stairs permitted **in** a dwelling unit in a *building* required to be of *noncombustible construction*? Why or why not?

4. Consider Figure M2:1 and Sentence 3.1.5.14.(1). Is there a problem with the framing of the lockers? Why or why not?

6. Indicate the Code reference that might allow the use of *combustible* products in a *building* required to be constructed of *noncombustible construction* in the table located on the following page.

Combustible Material	Applicable Code Reference for Noncombustible Construction
Vinyl faced gypsum wallboard	
Paper faced gypsum wallboard	
Polypropylene drain waste & vent pipe	
Electrical wire (14-2 romex)	
Vermiculite insulation	
Glass fibre insulation	
Wood strip flooring	
Wood frame partitions	
Heavy timber construction	
Vinyl window sashes and frames	
Silicone caulking	
Tar and gravel roof	
PVC or ABS drain waste & vent pipe	
Fire retardant plywood	
Gypsum wallboard Type X	
Styrofoam insulation	
Aluminium siding failing CAN/ ULC-S114 test	
Flame-resistant fabrics	

STOP

Exercise #3

Take about 10 minutes to read Articles 3.1.4.6. and 3.1.4.7. Answer the questions that follow, basing your answers on *fire-resistance ratings*, not structural applications. Compare your interpretations to those of the group. Use the flipchart to print common problems or questions. Class discussion will begin in about 15 minutes.

When a *building* is permitted to be constructed of *heavy timber construction*, provide the Code reference and state:

1. The minimum dimensions of a solid sawn rectangular column supporting a roof.

2. The minimum dimensions of a glue-laminated roof beam.

3. The minimum thickness of a solid sawn tongued-and-grooved roof deck.

4. The nature of the arrangement and smoothness of the wood elements in *heavy timber construction*.

STOP

7. Would the Code permit *combustible* piping to penetrate a *fire separation* of a floor assembly required to have a *fire-resistance rating*, if the piping was tightly fitted at the penetration using fire-resistive caulking (the caulking is not a listed fire stop)?

1. What are the flammability requirements for service entry of communication cables, in a *building* required to be of *noncombustible construction*, if the cables are not more than 3 m long and they are located in a *service room* that is separated from the remainder of the *building* by *fire separations*?

2. In a building regulated under Article 3.2.2.49., does the Code permit electrical wires with an FT4 rating, if the wires are located in a *plenum*?

3. In a building regulated under Article 3.2.2.49., would the Code permit the use of combustible duct sealants?

4. Consider a 3 *storey* high *building* required to be of *noncombustible construction*. For the items in the following table, identify if the Code permits their use in the construction of a 6 m high decorative *canopy* (note: the *canopy* is not located over an entrance into the *building*). Also indicate the appropriate Code reference.

Item	Permitted / Not Permitted	Reference
Wood columns		
Wood framing		
Roof sheathing		
Wood cladding		
Fabric covering conforming to CAN/ULC-S109		
Fire-retardant treated wood cladding		

STOP

COMBUSTIBLE INSULATION

Insulation is not an interior finish material. For *combustible* insulation materials and foamed plastic insulations, the standard flame-spread test does not provide a true measure of the relative hazard constituted by insulating materials in an actual fire. Foamed plastic insulation materials represent particular hazards: when exposed to fire, they produce dense smoke and release products of combustion that are both flammable and harmful.

Consequently, the Code requires most *combustible* insulation materials to be protected from adjacent spaces in the *building* by other, less hazardous building materials. The required protection is referred to as a **thermal barrier**.

Exercise #10

You can now identify the different types of thermal barriers required to protect *combustible* insulation in *buildings* required to be of *noncombustible construction*. Question #1 presents a partially completed chart that identifies Code references and the qualities of the various types of thermal barriers recognized by the Code.

Deal with the questions in the usual manner. The facilitator will assign flipchart work. Class discussion will follow in 30 minutes.

1. Complete the third column of the chart overleaf, with brief descriptions of the buildings where the referenced thermal barriers can be used.

Code	Description of Thermal Barrier	* Insulation Material Located in Building Conditions
Sentence 3.1.5.12.(2)	12.7 mm gypsum board or lath & plaster, mechanically fastened independent of insulation Masonry or concrete Classification B tested to CAN/ ULC-S124 and ULC listed at Guide 40 U 18.21D	
Sentence 3.1.5.12.(3)	12.7 mm gypsum board with joints either backed or taped and filled or lath & plaster, mechanically fastened independent of insulation 25 mm masonry or concrete Any thermal barrier meeting the temperature criteria after 10 min exposure to fire	

Code	Description of Thermal Barrier	* Insulation Material Located in Building Conditions
Sentence 3.1.5.12.(4)	12.7 mm gypsum board or lath & plaster, mechanically fastened independent of insulation Masonry or concrete Classification B tested to CAN/ULC-S124 and ULC listed at Guide 40 U 18.21D	
Sentence 3.1.5.12.(4)	15.9 mm Type X gypsum board with joints backed or taped & filled, mechanically fastened independent of insulation Nonloadbearing masonry/ concrete ≥50 mm *Loadbearing* masonry/concrete ≥75 mm CAN/ULC-S101 tested and ULC listed at Guide 40 U 18.21A	
Sentence 3.1.5.12.(6)	Factory-assembled exterior wall panel, CAN/ULC-S101 tested and ULC listed at Guide 40 U 18.21E	•

The Code requires *fire separations* to be continuous. *Closures* such as fire door assemblies allow *building* designers to respect this principle while allowing openings for the passage of people and goods from one part of the *building* to another.

Sentence 3.1.8.5.(2) of the Code informs us that generally, every fire door, window assembly or glass block used as a *closure* in a required *fire separation* must:

- be installed to conform with NFPA 80, "Fire Doors and Other Opening Protectives"; and
- have labels or classification marks to identify the testing laboratory, in cases where they are required to have a *fire-protection rating* (FPR).

OBJECTIVES

Upon completion of this module, you should be able to:

- State the provisions of the Code relating to various types of *closures*.
- Utilize the ULC Directories and the Supplementary Standards to the 2012 Building Code, as they relate to *closures*.
- Utilize NFPA 80 to verify the installation of various types of fire door assemblies.
- Identify problems with regard to *closures* during the course of plans examinations and inspections.
- Distinguish builders' hardware from fire door hardware.
- Differentiate fire-exit hardware from panic hardware, and specify where each can be installed.

STOP

GENERAL OVERVIEW OF NFPA 80

NFPA 80 regulates the installation of 13 different types of *closures*. It is therefore important that you understand that you cannot quote a requirement for the installation of horizontally sliding doors under Chapter 9, when in fact you are dealing with the installation of vertically sliding fire doors regulated by Chapter 10.

LABELLED RATING OF THE CLOSURE AND ITS COMPONENTS

As the components of a *closure* are built in a factory, it would be impossible for a building official to determine whether the required *fire-protection rating* was achieved, if the components were not labelled as required by Clause 3.1.8.5.(2)(b) of the Building Code.

Under ULC's Label Service Program, the manufacturer attaches labels to such of his products as are found, by the specified examinations and tests conducted by him, to be in compliance with the acceptable requirements. Representatives of the ULC make periodic visits to the factories in which the products are manufactured and labelled, for the purpose of checking the efficiency of the manufacturer's own inspection program. Should the Laboratories' representative observe features not in compliance with the requirements, the manufacturer is required either to correct such items before authorization to apply labels is given or to remove labels from the product.

INSTALLATION OF ACCESS DOORS AND CHUTE DOORS

Exercise #4

Figure M3:1 represents a *vertical service space* containing a refuse chute. For a refuse chute regulated by Clause 3.6.3.3.(2)(b), Table 3.1.8.4. informs us that both the chute door and the sprinkler-access door assembly require 1 1/2 h of *fire-protection rating*.

Examine Figure M3:1. From NFPA 80, read the definition of "access door", along with Chapters 15 and 16. Answer the questions and hold group discussion. The facilitator will assign flipchart work. Class discussion and review will start in 20 minutes.

Note that 15.1.2., 16.2.1.1. and 16.2.2.1. of NFPA 80 are not relevant, with respect to the Building Code. Likewise, at 16.2.2.3., the words "exposure to the standard fire test as described in NFPA 252, Standard Methods of Fire Tests of Door Assemblies," do not apply.

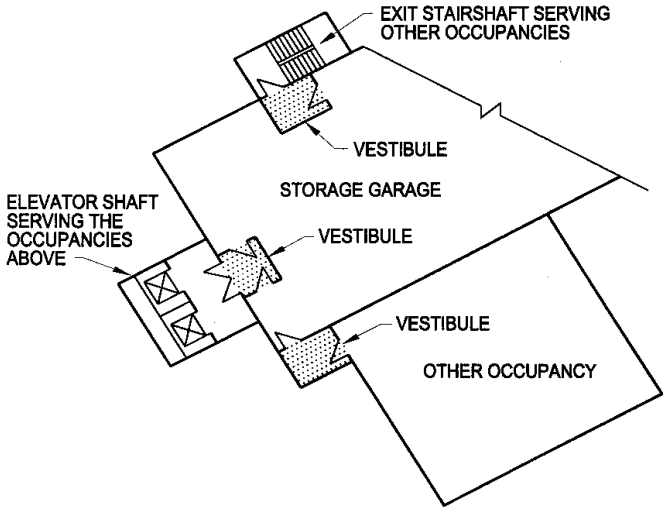

FIGURE M3:5 HOLD-OPEN DEVICES AND VESTIBULES

Hold-open devices are not permitted on doors of vestibules required from a *storage garage* to:

- a stair tower (Sentence 3.3.5.4.(1)) serving *occupancies* above the level of the *storage garage*, or
- an elevator (Sentence 3.3.5.4.(1)) serving *occupancies* above the level of the *storage garage*, or
- an *occupancy* adjacent to a *storage garage* (Sentences 3.3.5.7.(1), (2) and (3)).

Exercise #16

Hold-open devices for doors in *fire separations*, including *exit* doors, are dealt with in Article 3.1.8.12. and Sentence 3.4.6.13.(1) of the Building Code. Take a couple of minutes to read these items and to answer the questions. See if the group feels the same as you. Use Table 3:1 to answer the assigned question. General discussion will begin in 25 minutes.

WAIVING THE REQUIREMENT FOR FIRE DAMPERS

The Building Code permits *fire dampers* to be omitted when certain conditions listed in Article 3.1.8.8. are met. The 2012 Building Code permits dampers to be omitted in connection with Group B, Division 3 *occupancies*.

Sentence 3.1.8.8.(8) waives the requirement for *fire dampers* to be provided where the duct penetrates a *fire separation* in a Group B, Division 3 sleeping room under the following conditions:

- sleeping accommodation for maximum 10 persons,
- maximum 6 occupants require assistance in evacuation,
- *building* equipped with a fire alarm system, and
- duct-type *smoke detectors* are installed to control smoke circulation as described in Article 3.2.4.13.

STOP

BUILDING SERVICES IN FIRE SEPARATIONS AND FIRE-RATED ASSEMBLIES

Clause 3.1.9.1.(1)(a) authorizes *noncombustible* piping to penetrate a membrane forming part of an assembly required to have a *fire-resistance rating* to be sealed by a fire stop that, when subjected to the fire test method in CAN/ULC-S115, "Fire Tests of Firestop Systems", has an F rating not less than the *fire-protection rating* required for closures in the *fire separation*. In the case of a *firewall*, Sentence 3.1.9.1.(2) informs us that the fire stop requires an FT rating that is not less than the *fire-resistance rating* of the *fire separation*.

The 2012 Building Code added the following requirements for fire stopping of penetrations of fire separations;

- that penetrations of *horizontal service spaces* located above a required vertical *fire separation* other than a vertical shaft, shall be sealed by a *fire stop* that, when subjected to the fire test method in CAN/ULC-S115, "Fire Tests of Firestop Systems", has an FT rating not less than the *fire-resistance rating* required for the *fire separation* of the assembly.

- Sprinklers are permitted to penetrate a *fire separation* or a membrane forming part of an assembly required to have a *fire-resistance rating* without having to meet the *fire stop* requirements of Sentence (1), (2) or (3), provided the annular space created by the penetration of a fire sprinkler is covered by a metal escutcheon plate in accordance with NFPA 13, "Installation of Sprinkler Systems".
- Unless specifically designed with a *fire stop, fire dampers* are permitted to penetrate a *fire separation* or a membrane forming part of an assembly required to have a *fire-resistance rating* without having to meet the *fire stop* requirements of Sentences 3.1.9.1. (1), (2) or (3), provided the *fire damper* is installed in conformance with NFPA 80, "Fire Doors and Other Opening Protectives".

Exercise #2

From ULC's Online Directory, read about fire stops at Guide 40 U19 (CCN No. XHEZC). Follow the established procedure to deal with the questions. The facilitator will assign flipchart work. Class discussion will begin in 15 minutes.

1. Define F rating.

2. Define FT rating.

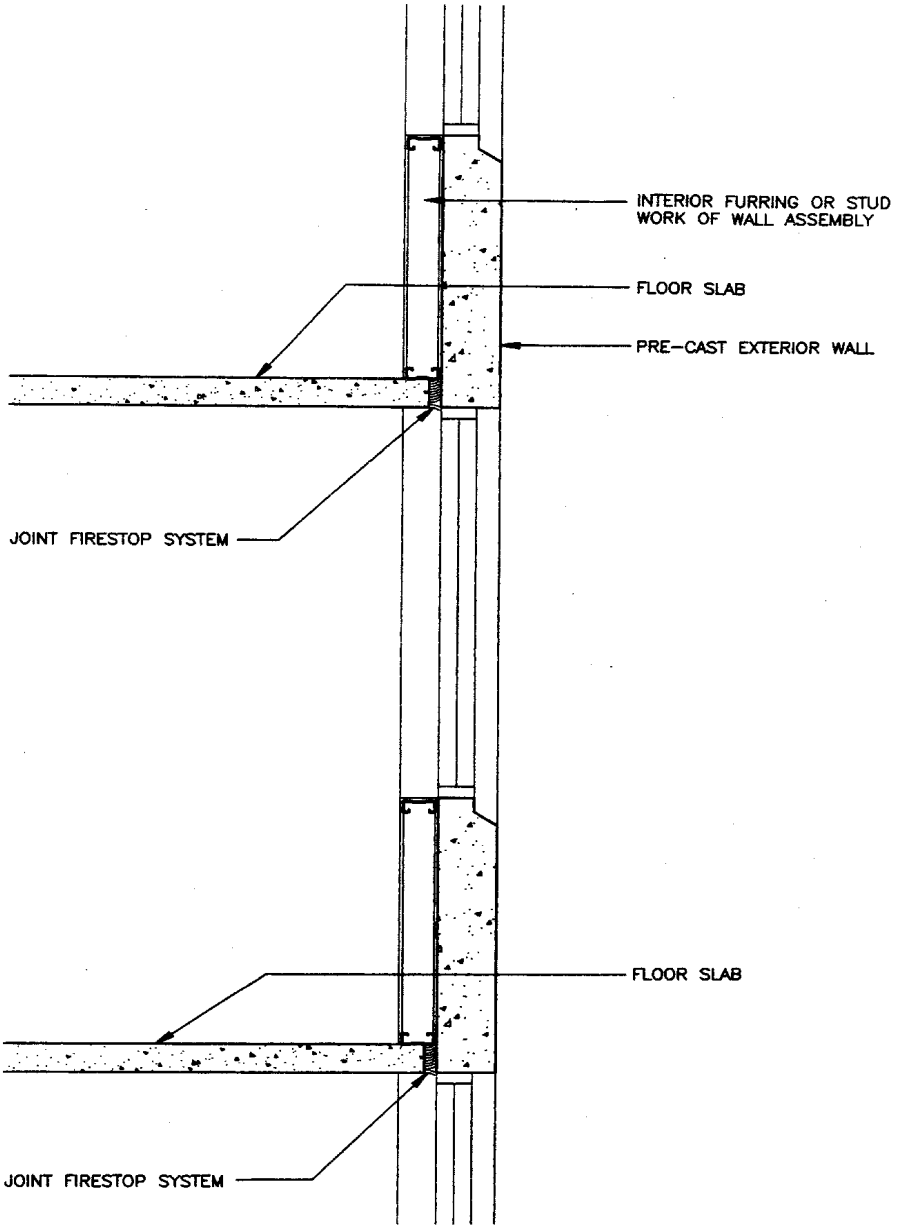

FIGURE M4:3 JOINT FIRE STOP—TYPICAL WALL SECTION

3. Consider Figure M4:2 and select a service penetration system, if the steel conduit has a 75 mm diameter and the cables on either side of the pipe are PVC jacketed and the size and construction of the *building* is determined from Article 3.2.2.57.

4. Consider Figure M4:3. You are dealing with the same *building* as in Question #3. Select an acceptable joint fire stop (JF).

STOP

COMBUSTIBLE PIPING SERVICE PENETRATIONS

Sentence 3.1.9.4.(4) permits *combustible* piping to penetrate a *fire separation* required to have a *fire-resistance rating*, or is permitted to penetrate a membrane that forms part of an assembly required to have a *fire-resistance rating*, provided that the piping is sealed at the penetration by a fire stop that has an F rating not less than the FRR required for the *fire separation* when subjected to the fire test method in CAN/ULC-S115, "Fire Tests of Firestop Systems", with a pressure differential of 50 Pa between the exposed and unexposed sides, and with the higher pressure on the exposed side.

Combustible piping is also allowed to penetrate a *fire separation* under the following conditions [Sentences 3.1.9.4.(4) through (8)]:

1. Consider that the piping in Figure M4:2 is of *combustible* materials. Select a service penetration fire stop that would be suitable for this location. (The *building* is still regulated by Article 3.2.2.57.)

STOP

consistent with that required for the *fire-resistance rating* of the wall, as if it were a *fire separation*. If the rise of temperature is higher than that permitted for the wall, the concept of equivalent *unprotected opening* has to be applied.

Tables 3.2.3.1.A. through E do not list all of the possible values for *limiting distance* and area of *exposing building face*. Intermediate values can be determined by interpolation.

Exercise #2

Read Sentences 3.2.3.1.(1), (2), (4), (5), (6), and (7) and Article 3.2.3.2., and consider Figure M5:1. Class discussion begins in 60 minutes.

1. Calculate the area of *unprotected opening(s)* permitted in the South *exposing building face*. The known values are as follows:
   - The *limiting distance* is 3.43 m.
   - The fire department is four blocks away.
   - Each *fire compartment* is 3 m by 7.5 m at the EBF.
   - The *building* will be used for offices.
   - The openings are not protected by wired glass in fixed steel frames.
   - The *building* is not *sprinklered*.

3. Describe the construction of the *exposing building face*.

STOP

FIRE EXPOSURE BETWEEN FIRE COMPARTMENTS

Article 3.2.3.14. acts as safeguard, to ensure that the function of interior *fire separations* is not defeated by allowing the fire to spread via the exterior of the *building*.

Where two *exposing building faces* form an angle of 135° or less (in the case of parallel EBFs, the angle of intersection is 0°), there is a potential danger of fire spreading from one *fire compartment* to the other, if the walls contain openings or do not have a sufficient *fire-resistance rating*. To reduce this risk, each exterior wall must be constructed with limits on the amount of *unprotected openings* and

MODULE 2 - NONCOMBUSTIBLE CONSTRUCTION

Exercise #1

For Questions #1 and #2 you must refer to the appropriate section of the Building Code.

1. Identify the test that recognizes whether a building material is *noncombustible* or *combustible*.

   CAN/ULC-S114, "Test for Determination of Non-Combustibility in Building Materials" - Division A, Sentence 1.4.1.2.(1); Division B, Table 1.3.1.2.

2. Can a *combustible* product be changed to a *noncombustible* product with the addition of a fire-retardant chemical?

   No. Subsection 4.2.3. of SB-2.

Exercise #2

This exercise is designed to provide you with an overview of the various *combustible* components that are permitted when *noncombustible construction* is required.

Read the headings under Articles 3.1.5.1. to 3.1.5.26., and answer the questions. Follow the established procedure. Class discussion will begin in 35 minutes.

1. You encounter a product, any product, of questionable noncombustibility. It cannot be identified as *noncombustible* by Section 4, of Supplementary Standard SB-2. The *building* is regulated by Article 3.2.2.57. of the Building Code. What would you do to ensure that Article 3.1.5.1. is not being contravened?

   Sentence 3.2.2.57.(2) requires noncombustible construction. Article 3.1.5.1. requires noncombustible construction from noncombustible materials except when otherwise permitted.

   A building official might issue an order under 18.(1)(f) of the BCA requesting a test; or the owner could substitute an acceptable material.

The test could be based on CAN/ULC-S114, CAN/ULC-S135, or an Alternative Solution can be prepared using an alternate test standard that will provide comparable results.

2. Imagine that the product in Question #1 is tested. The results indicate that it **failed** to meet the acceptance criteria of CAN/ULC-S114, "Test for Determination of Non-Combustibility in Building Materials".

   a) What action would a CBO take to ensure Code compliance?

      Issue an order directing compliance with the Building Code, pursuant to Subsection 12.(2) of the Building Code Act.

3. Are *combustible* stairs permitted **in** a dwelling unit in a *building* required to be of *noncombustible construction*? Why or why not?

   Yes; allowed by Article 3.1.5.9.

4. Consider Figure M2:1 and Sentence 3.1.5.14.(1). Is there a problem with the framing of the lockers? Why or why not?

   No problem. Sentence 3.1.5.14.(1) allows wood lockers in buildings of residential occupancy.

5. Evaluate Figure M2:2. Not considering the other Code requirements (*access to exit*, guards, fire stopping, etc), would you accept what is being proposed? Why or why not?

   No, for two reasons:

   Partitions referenced in Article 3.1.5.13. must, by definition, Division A Sentence 1.4.1.2.(1), be not loadbearing.

   Contrary to Sentence 3.1.5.8.(2), the floor joists are not applied directly to or set into a noncombustible floor slab.

6. Indicate the Code reference that might allow the use of *combustible* products in a *building* required to be constructed of *noncombustible construction* in the table located on the following page.

Combustible Material	Applicable Code Reference for Noncombustible Construction
Vinyl faced gypsum wallboard	3.1.5.11.
Paper faced gypsum wallboard	3.1.5.11.
Polypropylene drain waste & vent pipe	3.1.5.16.(3)
Electrical wire (14-2 romex)	3.1.5.18.
Vermiculite insulation	3.1.5.12.
Glass fibre insulation	3.1.5.12.
Wood strip flooring	3.1.5.8.(3)
Wood frame partitions	3.1.5.13.
Heavy timber construction	3.1.5.1.(1), 3.2.2.16.
Vinyl window sashes and frames	3.1.5.4.(5)
Silicone caulking	3.1.5.2.(1)(b)
Tar and gravel roof	3.1.5.3.(1)
PVC or ABS drain waste & vent pipe	3.1.5.16.(1)
Fire retardant plywood	3.1.5.10.(2)
Gypsum wallboard Type X	3.1.5.11.
Styrofoam insulation	3.1.5.12.
Aluminium siding failing CAN/ ULC-S114 test	3.1.5.5.
Flame-resistant fabrics	3.1.16.1.

Exercise #3

Take about 10 minutes to read Articles 3.1.4.6. and 3.1.4.7. Answer the questions that follow, basing your answers on *fire-resistance ratings*, not structural applications. Compare your interpretations to those of the group. Use the flipchart to print common problems or questions. Class discussion will begin in about 15 minutes.

When a *building* is permitted to be constructed of *heavy timber construction*, provide the Code reference and state:

1. The minimum dimensions of a soild sawn rectangular column supporting a roof.

   140 mm by 191 mm

   Table 3.1.4.7., Column 3

2. The minimum dimensions of a glue-laminated roof beam.

   80 mm by 152 mm

   Table 3.1.4.7., Column 4

3. The minimum thickness of a solid sawn tongued-and-grooved roof deck.

   38 mm

   Clause 3.1.4.7.(6)(a).

4. The nature of the arrangement and smoothness of the wood elements in *heavy timber construction*.

   Arranged in heavy solid masses with smooth flat surfaces to avoid thin sections and sharp projections.

   Sentence 3.1.4.7.(1).

Exercise #4

1. Does the Code permit the use of *combustible* light diffusers as illustrated in Figure M2:3?

   Yes – Sentence 3.1.5.1.(1) includes Article 3.1.13.4. as a permitted exception. Sentence 3.1.13.4.(1) gives specific requirements for use of combustible light diffusers.

2. Does the Code permit the use of *combustible* light diffusers as illustrated in Figure M2:4?

   No – Sentence 3.1.5.1.(1) includes Article 3.1.13.4. as a permitted exception. Clause 3.1.13.4.(1)(d) does not permit combustible light diffusers in a fire separated corridor unless individual diffusers or lenses are not more than 1 m² in area and are not less than 1 200 mm apart.

3. Does the Code permit the use of the proposed suspended ceiling illustrated in Figure M2:5?

   No – Clause 3.1.5.10.(3)(b) limits the flame-spread rating to not more than 25, and Table 3.1.1.A. of SB-2 lists lumber to have a flame-spread rating of 150.

4. If the answer to Question #3 is no, what measures could be taken in order to allow the ceiling shown in Figure M2:5?

   Change to a product that meets the flame-spread rating or select a listed coating that will reduce the flame-spread rating of the lumber from 150 to not more than 25 on any exposed surface, or on any surface that would be exposed by cutting through the material in any direction.

   Also, Clause 3.1.5.10.(3)(b) lists fire-retardant treated wood as acceptable.

5. For the list of items extracted from Figure M2:6, indicate if the Code permits or does not permit their use. Give the Code reference as well.

   Vinyl wall paper: Permitted - Sentences 3.1.5.10.(1), 3.1.5.11.(1).

   Wall carpet: Max. 1 mm thick with any flame-spread rating or max. 25 mm thick with flame-spread rating not exceeding 150. – Sentences 3.1.5.10.(1) & (2)

   Pegboard: Max. 25 mm thick with flame-spread not exceeding 150. – Sentence 3.1.5.10.(2)

   Cork: Max 1 mm thick any flame-spread, or max. 25 mm thick with flame-spread not exceeding 150.
   – Sentences 3.1.5.10.(1) & (2)

3. In a *building* required to be of *noncombustible construction*, would *combustible* piping connected to *noncombustible* piping conform with Clause 3.6.4.3.(1)(a), if the *combustible* portion remains outside the *plenum* space? (see Figure M2:8)

   Yes, as long as materials that are within the plenum space have a flame-spread rating of not more than 25 and a smoke developed classification not more than 50. – Clause 3.6.4.3.(1)(a)

4. Would PVC piping, listed in Table 2:1, be permitted throughout the *floor area* in a 12 storey Group D *building* if the floor level of the top *storey* is more than 36 m above *grade*?

   No. PVC has a smoke developed classification greater than 50. – Clause 3.1.5.16.(1)(b)

5. Would the PVC piping in Question #4 be permitted if it were only located in concealed wall spaces?

   Yes – Sentence 3.1.5.16.(1)

6. Would the PVC piping in Question #4 be permitted to be used in a *vertical service space?*

   No. Only allowed in concealed wall spaces or concrete floor slab. – Sentence 3.1.5.16.(1)

7. Would the Code permit *combustible* piping to penetrate a *fire separation* of a floor assembly required to have a *fire-resistance rating*, if the piping was tightly fitted at the penetration using fire-resistive caulking (the caulking is not a listed fire stop system)?

   No. Tightly fitted only applies to services which are noncombustible and are cast in situ with concrete. Filling gaps with mortar, cement grout, or other compound that is not a listed fire stop are not considered adequate substitutes or explicitly allowed by the Building Code because these materials will shrink upon drying and most importantly, not stay in place under the high temperature of a fire – Sentence 3.1.9.4.(4) must be sealed with a fire stop.

8. If the penetration described in Question #7 was composed of tightly fitted *noncombustible* piping at the penetration connected to *combustible* piping beyond the point of penetration, would the Code allow it?

   No. This pipe system cannot be classified as noncombustible, since part of the pipe system is composed of combustible piping. For this arrangement the pipe system is considered combustible and therefore would not meet the requirement for tightly fitted as specified in Clause 3.1.9.1.(1)(b) (metal is a good thermal conductor and would transmit sufficient heat from one side of the separation to the other side where the combustible part of the pipe system is connected) – Sentence 3.1.9.4.(4) must be sealed with a fire stop.

Exercise #6

The Code recognizes the need to permit the use of electrical wires and cables with *combustible* coverings to ensure that the electrical distribution system is adequately insulated to prevent electrical problems. To minimize the involvement of electrical wires and cables in fires and their spread, limits are placed on the flammability of exposed portions.

Read Articles 3.1.5.18 to 3.1.5.21, 3.6.4.3., and 6.2.3.2. Answer the questions that follow. Compare your answers to those of the group. Use the flipchart to print your groups answers. Class discussion will begin in about 30 minutes.

1. What are the flammability requirements for service entry of communication cables, in a *building* required to be of *noncombustible construction*, if the cables are not more than 3 m long and they are located in a *service room* that is separated from the remainder of the *building* by *fire separations*?

   No requirements. – Subclause 3.1.5.18.(1)(b)(iv) and Clause (c)

2. In a building regulated under Article 3.2.2.49., does the Code permit electrical wires with an FT4 rating, if the wires are located in a *plenum?*

   No, must be FT6 - Subclause 3.6.4.3.(1)(a)(ii).

3. In a building regulated by 3.2.2.69., would the Code permit the use of combustible duct sealants?

   Yes, provided that the duct sealants have a flame-spread rating of not more than 25 and a smoke developed classification of not more than 50. – Sentence 6.2.3.2.(3)

4. Under what conditions are FT1 rated electrical wires permitted in a *building* required to be of *noncombustible construction*?

   - When located in enclosed noncombustible raceways. – Subclause 3.1.5.18.(1)(b)(i)
   - When located in concealed wall spaces. – Subclause 3.1.5.18.(1)(b)(ii)
   - When located in concrete slabs. – Subclause 3.1.5.18.(1)(b)(iii)
   - When located in a service room separated from the remainder of the building by a fire separation having a fire-resistance rating of not less than 1 h. – Subclause 3.1.5.18.(1)(b)(iv)
   - When located in totally enclosed nonmetallic raceways conforming to Clause 3.1.5.20.(1)(b). – Subclause 3.1.5.18.(1)(b)(v)
   - The wires and cables are communication cables used at the service entry to a building and are not more than 3m long. – Clause 3.1.5.18.(1)(c)
   - When used on elevating devices. – Sentence 3.1.5.19.(1)
   - When they are located in the space below a raised floor in a computer room. – Sentence 3.1.5.21.(1)

Exercise #7

Read Articles 3.1.5.3., 3.1.5.4., 3.1.5.5., 3.1.5.23., 3.1.5.25., 3.1.16.1. and 3.1.11.5. Answer the questions that follow. Compare your answers to those of the group. Use the flipchart to print your groups answers. Class discussion will begin in about 30 minutes.

1. Does the Code permit the use of a 6 m high wood *canopy* along the entire front face of a large one *storey* mercantile plaza, if the *building* is *sprinklered* and required to be of *noncombustible construction*. (Note: all tenant main entrances are located along the front of the *building*)

4. Consider a 3 *storey* high *building* required to be of *noncombustible construction*. For the items in the following Table, identify if the Code permits their use in the construction of a 6 m high decorative *canopy* (note: the *canopy* is not located over an entrance into the *building*). Also indicate the appropriate Code reference.

Item	Permitted / Not Permitted	Reference
Wood columns	not permitted	3.1.5.1.(1)
Wood framing	not permitted	3.1.5.1.(1), 3.1.5.3.(2)
Roof sheathing	not permitted	3.1.5.3.(2)
Wood cladding	not permitted	3.1.5.5.(6)
Fabric covering conforming to CAN/ULC-S109	permitted	3.1.16.1.(1)
Fire-retardant treated wood cladding	permitted if passes tests	3.1.5.5.(5)

Protection of Combustible and Foamed Plastic Insulation in Buildings Required to Be of Noncombustible Construction

Where is this identified in the Code?

Articles 3.1.5.1., 3.1.5.12.

For all locations, which Sentences in the Code regulate:

- foamed plastic insulation having a *flame-spread rating* of not more than 25

  Sentence 3.1.5.12.(2)

- *combustible* insulation other than foamed plastics

  Sentence 3.1.5.12.(1)

You have received a set of plans for a *noncombustible building* with a detail showing an exterior wall containing *combustible* foam insulation having a *flame-spread rating* of 495 and showing the adjacent space inside the *building* (a corridor) protected with 12.7 mm gypsum board mechanically fastened to a supporting assembly independent of the insulation.

This detail is for a 4 *storey* building and also shows a curtainwall exterior made of 14 ga. steel.

1. Is the thermal barrier necessary for the example sited?

   Yes – Sentence 3.1.5.12.(3)

2. Is the exterior protection sufficient for the example sited?

   Yes – Sentence 3.2.3.8.(1)

3. An interior wall contains foamed plastic insulation having a *flame-spread rating* of 498. Do adjacent spaces need to be protected?

   Yes – Sentence 3.1.5.12.(4)

4. A *vertical service space* containing plumbing insulated with treated foamed plastic needs to be protected in what manner?

   Protected in conformance with Article 3.1.5.12.
   – Sentence 3.6.3.2.(1)

Exercise #8

Take about 10 minutes to read Article 3.1.5.12. Read Sentence 3.6.3.2.(1) and Sentence 6.2.3.4.(5). As you read along, you will conclude that for each situation where protection is required, the Code offers choices amongst a number of thermal barriers.

Deal with the questions in the usual manner. Support your answers with appropriate references.

Class discussions will follow in 25 minutes. Standard procedures apply. The facilitator will assign flipchart work.

The standard procedure applies. Class discussions will begin in 40 minutes.

1. a) Summarize the qualities (including the specified test standard) of a **classification B** thermal barrier, as referenced in Clause 3.1.5.12.(2)(e).

   Main concern: the temperature rise over a given period of time.

   b) State an example of a classification B thermal barrier.

   A 18 mm sprayed layer of A/D Cementitious Thermal Barrier, of minimum average density of 380 kg/m^3 with no individual value less than 370 kg/m^3, from A/D Fire Protection Systems, listed at Guide 40 U 18.21D (CCN No. CAWOC) from ULC Handbook, Fire Resistance.

2. a) Summarize the qualities (including the specified test standard) of a thermal barrier for **interior surfaces of exterior walls**, as referenced in Clause 3.1.5.12.(3)(d).

   They are tested and classified in accordance with CAN/ULC-S101, "Fire Endurance Tests of Building Construction and Materials". During the first 10 minutes of testing, the listed thermal barrier will not develop an average temperature rise of more than 140°C, nor a rise of over 180°C at any point on its unexposed face.

   b) State an example of this type of thermal barrier.

   Products listed under Guide No. 40 U18.21D (CCN No. CAWOC), "Protective Coverings for Foamed Plastic" as Classification B or listed under Guide No. 40 U18.21 (CCN No. XCLAC), "Thermal Barriers", from ULC Handbok, Fire Resistance are in compliance with Article 3.1.5.12.(3)(d).

   A 18 mm sprayed layer of A/D Cementitious Thermal Barrier, of minimum average density of 380 kg / m^3 with no individual value less than 370 kg/m^3, from A/D Fire Protection Systems, which is listed as Classification B under Guide No. 40 U18.21D (CCN No. CAWOC).

3. a) Summarize the qualities (including the specified test standard) of a thermal barrier for **interior walls**, as referenced in Clause 3.1.5.12.(4)(d).

They are tested and classified in accordance with CAN/ULC-S101, "Fire Endurance Tests of Building Construction and Materials". During the first 20 minutes of testing, the listed thermal barrier will not develop an average temperature rise of more than 140°C, nor a rise of over 180°C at any point on its unexposed face, and will remain in place for not less than 40 minutes.

b) State an example of this type of thermal barrier.

Design No. TB2, as listed under Guide 40 U18.21A (CCN No. XCLFC) will provide the thermal barrier protection for 45 minutes.

4. a) Summarize the qualities of a factory-assembled exterior wall panel incorporating foamed plastic insulation that satisfies Sentence 3.1.5.12.(6).

- The foamed plastic must have FSR ≤500. – Sentence 3.1.5.12.(6)
- The panel cannot incorporate an air space. – Sentence 3.1.5.12.(6)
- The panel must be tested per CAN/ULC-S101. – Clause 3.1.5.12.(6)(a)
- 0.38 mm sheet steel on both sides of panel, and will remain in place for at least 10 min. – Clause 3.1.5.12.(6)(a)
- FSR of panel finish cannot exceed FSR permitted for walls of adjacent rooms/spaces. – Clause 3.1.5.12.(6)(b)
- Cannot be used in buildings containing a Group B or C major occupancy. – Clause 3.1.5.12.(6)(c)
- Building is not more than 18 m between grade and floor of uppermost storey. – Clause 3.1.5.12.(6)(d)

b) State an example of this type of panel.

Supra, Galvatherm, and Hi-Rib wall panels by Galvamet America Corp, as listed under Guide 40 U18.21E (CCN No. CBZZC) of the ULC Handbook, Fire Resistance.

5. a) In addition to the requirements of Sentence 3.1.5.12.(3), where foamed plastic insulation is used in an exterior wall of a *building* more than three *storeys* in *building height*, the insulation is required to be protected on the exterior surface, by a thermal barrier satisfying Clause 3.2.3.8.(1)(b). Summarize the qualities (including the test standard) of a suitable thermal barrier.

   - Made of noncombustible material,
   - Tested per CAN/ULC-S101,
   - Must remain in place for at least 15 minutes under test conditions.

   b) State an example of this type of thermal barrier.

   "EIFS Category 2"; Akrilon Styro-Wall 2.5 mm thick with Akrilon Designer Plaster Finish by Akrilon Industries Inc., as listed under "EIFS" of Intertek's 2006 Directory of Listed Products.

Exercise #10

You can now identify the different types of thermal barriers required to protect *combustible* insulation in *buildings* required to be of *noncombustible construction*. Question #1 presents a partially completed chart that identifies Code references and the qualities of the various types of thermal barriers recognized by the Code.

Deal with the questions in the usual manner. The facilitator will assign flipchart work. Class discussion will follow in 30 minutes.

1. Complete the third column of the chart overleaf, with brief descriptions of the buildings where the referenced thermal barriers can be used.

ANS

Code	Description of Thermal Barrier	* Insulation Material Located in Building Conditions
Sentence 3.1.5.12.(2)	12.7 mm gypsum board or lath & plaster, mechanically fastened independent of insulation Masonry or concrete Classification B tested to CAN/ ULC-S124, and ULC listed at Guide 40 U 18.21D	Foamed plastic, FSR ≤25 in: • All locations in every building

Code	Description of Thermal Barrier	* Insulation Material Located in Building Conditions
Sentence 3.1.5.12.(3)	12.7 mm gypsum board with joints either backed or taped and filled or lath & plaster, mechanically fastened independent of insulation 25 mm masonry or concrete Any thermal barrier meeting the temperature criteria after 10 min exposure to fire	Combustible insulation including foamed plastic with FSR > 25 but ≤500 in exterior walls of: • buildings that are not sprinklered and are more than 18 m high • 3.2.6. buildings that are not sprinklered
Sentence 3.1.5.12.(4)	12.7 mm gypsum board or lath & plaster, mechanically fastened independent of insulation Masonry or concrete Classification B tested to CAN/ULC-S124, and ULC listed at Guide 40 U 18.21D	Combustible insulation including foamed plastic with FSR > 25 but ≤500 in interior walls of: Sprinklered buildings more than 18 m high Sprinklered buildings constructed under Subsection 3.2.6. Non-3.2.6. buildings ≤18 m high that are not sprinklered
Sentence 3.1.5.12.(4)	15.9 mm Type X gypsum board with joints backed or taped & filled, mechanically fastened independent of insulation Nonloadbearing masonry/concrete ≥50 mm *Loadbearing* masonry/concrete ≥75 mm CAN/ULC-S101 tested and ULC listed at Guide 40 U 18.21A	Combustible insulation including foamed plastic with FSR > 25 but ≤500 in interior walls of: • Buildings more than 18 m high that are not sprinklered • Buildings that are not sprinklered and are constructed under Subsection 3.2.6.
Sentence 3.1.5.12.(6)	Factory-assembled exterior wall panel, CAN/ULC-S101 tested and ULC listed at Guide 40 U 18.21E	Thermosetting foamed plastic insulation with FSR ≤500 in exterior wall panels of: • Any building not more than 18 m high without Group B or C major occupancy • When more than 3 storeys in building height, exterior surface must be protected in accordance with Sentence 3.2.3.8.(1)

Code	Description of Thermal Barrier	* Insulation Material Located in Building Conditions
Sentence 3.2.3.8.(1)	• Masonry/concrete ≥25 mm • CAN/ULC-S101 tested and Intertek listed at Wall Exterior Insulation & Finish Systems (EIFS) • Article 3.1.5.5. tested *combustible* cladding meeting CAN/ULC-S134	4 storey, sprinklered building with exterior wall composed of 10" concrete block with rigid type combustible insulation on exterior face (i.e., foamed plastic with FSR >25 and ≤500): • Block wall provides the thermal barrier protection for the interior of the building. – Clause 3.1.5.12.(3)(c) • Ok if exterior face of insulation is protected in conformance with Sentence 3.2.3.8.(1) and where the maximum permitted area of unprotected openings is greater than 10% of the exposing building face. • Ok if exterior face of insulation conforms with Article 3.1.5.5. when the exposing building face is regulated by Sentences 3.2.3.7.(1) and where the maximum permitted area of unprotected openings is greater than 10% of the exposing building face. – Sentence 3.2.3.8.(3) • Not permitted for any exposing building face regulated by Sentence 3.1.5.5.(3). – Sentences 3.1.5.5.(1), 3.2.3.8.(1)

* Other than adjacent concealed spaces within wall assemblies where protection is not required.

2. Consider loose-fill, cellulose-based insulation (i.e., non-foamed plastic) with a *flame-spread rating* in excess of 25.

   a) How must it be protected?

   Sentence 3.1.5.12.(1) indicates that it must be protected as described in Sentences 3.1.5.12.(3) and (4).

B *Roof space* as a *plenum*:

Cover with a noncombustible product with an FRS ≤ 25 and SDC ≤ 50. – Clause 3.6.4.3.(1)(a)

C Foamed plastic above a roof deck:

Sentence 3.1.5.12.(5)

D Interior wall assembly:

Building <18 m and non–3.2.6.
– Sentence 3.1.5.12.(4) → Sentence 3.1.5.12.(2)

E Interior wall assembly in a *roof space*, with no *plenum*

Building < 18 m and non-3.2.6.
– Sentence 3.1.5.12.(4) → Sentence 3.1.5.12.(2)

F Exterior wall assembly in a *roof space*, with no *plenum*:

Building < 18 m and non-3.2.6.
– Sentence 3.1.5.12.(3) → Sentence 3.1.5.12.(2)

G Foamed plastic beneath a concrete slab:

No thermal barrier required exempted by Sentence 3.1.5.12.(5)

H Foamed plastic outside a *foundation* wall below ground level:

No thermal barrier required exempted by Sentence 3.1.5.12.(5)

3. Would your answers in Question #2 have been different, if the *building* were *sprinklered*?

No. In buildings that are less than 18 m high and not regulated by Subsection 3.2.6., sprinklering offers no reduction of the requirements for thermal barriers.

3. Which document is used to determine the required *fire-protection rating* of a *closure* in a *fire separation*?

   The Building Code – Article 3.1.8.1. → Sentence 3.1.8.4.(2) → Table 3.1.8.4.

4. Identify the standard test that is used to determine the fire-protection rating of fire door assemblies.

   Tests conducted in conformance with CAN4-S104, "Fire Tests of Door Assemblies". – Clause 3.1.8.4.(1)(a)

5. a) When inspecting the installation of fire door assemblies, how important are the manufacturer's installation instructions?

   Very important. They ensure that the assembly is typical and representative of the tested assembly.

   b) When inspecting the installation of fire door assemblies, what can a building inspector do to obtain a copy of the manufacturer's installation instructions?

   If verbal requests fail, issue an order under the authority of Clauses 18.(1)(a) or 18.(1)(c) of the Building Code Act.

Exercise #3

From Chapter 3 of your copy of NFPA 80, read the definitions of fire door, fire door assembly, and fire door hardware. Read NFPA 80, Section 4.6, Classification of Hardware for Fire Doors, as well.

From ULC's Directory, Building Materials, read about fire doors at Guide 120 ID0 (CCN No. GSNVC) (do not read beyond the sample labels). Read Hardware Guide 120 ID16 (CCN No. GWGRC), Builders Hardware Guide 120 ID16.2 (CCN No. GWTZC) and Fire Door Hardware Guide 120 ID16.6 (CCN No. GZYXC).

Follow the established procedure to deal with the questions. The facilitator will assign flipchart work. Class discussion will start in 45 minutes.

1. Define fire door.

   The door component of a fire door assembly.

Exercise #16

Hold-open devices for doors in *fire separations*, including *exit* doors, are dealt with in Article 3.1.8.12. and Sentence 3.4.6.12.(1) of the Building Code. Take a couple of minutes to read these items and to answer the questions. See if the group feels the same as you. Use table 3:1 to answer the assigned question. General discussion will begin in 25 minutes.

1. Identify those doors where the installation of a hold-open device is prohibited.

   - Every exit door in a building more than three storeys in building height. – Clause 3.4.6.13.(1)(b) → Sentence 3.1.8.12.(1)
   - Doors to vestibules between a storage garage and Group A, Division 1 and Group B occupancies. – Sentence 3.1.8.12.(1) → Sentence 3.3.5.7.(1), Sentence 3.3.5.7.(3)
   - Doors to vestibules between a storage garage and Group A, Division 2, 3 or 4 and Group C occupancies in buildings more than 3 storeys in height. – Sentence 3.1.8.12.(1) → Sentence 3.3.5.7.(2), Sentence 3.3.5.7.(3)
   - Doors to vestibules between a storage garage and stair tower or elevator. – Sentence 3.1.8.12.(1) → Sentence 3.3.5.7.(3) → Sentence 3.3.5.4.(1) & Clause 3.3.5.7.(3)(c)

2. For which *occupancies* are hold-open devices permitted to be released singly by a signal from a dedicated *smoke detector* when a fire-alarm system is not provided?

   All occupancies at listed locations in Sentence 3.1.8.12.(3), except for doors located between a corridor used by the public and adjacent sleeping rooms in Group B occupancies – Sentence 3.1.8.12.(6) requires the additional signal from a fire alarm system.

4. Select fire *exit* hardware that can be used with the fire door in Question #2.

   Series 650 and 1650 single-point rim type latches for use on single swinging 20 minute wood core fire doors, from Lockwood TM. – Guide 120 ID16.2.6 (CCN No. GXHXC) of the ULC Directory, Building Materials

   Also, Guide 120 ID16.2.6 (CCN No. GXHXC) requires through bolts when fire-exit hardware is used on 20-minute wood-core doors.

5. Specify the clearances required at the bottom, sides and top between a twenty-minute wood-core fire door and its frame.

   Not more than 6 mm at the bottom, and not more than 3 mm at the sides and top. – Sentence 3.1.8.10.(3)

MODULE 4 - CONTINUITY OF FIRE SEPARATIONS AND FIREWALLS

Exercise #1

Take 10 minutes to read what ULC's Directory, Building Materials, has to say about dampers at Guide 20 I8 (CCN No. EMMEC), 20 I8.5 (CCN No. EMNOC), and 20 I8.12 (CCN No. EMQIC). Deal with the questions in the usual way. The facilitator will assign flipchart work. Class discussion will follow in 20 minutes.

1. Consider the HVAC system of the non-Subsection 3.2.6. *building* with a *mercantile occupancy* in Figure M4:1. Floors are 2 h *fire separations*. Identify a *fire damper* manufactured by Nailor Industries Inc. that could be installed in openings of the *vertical service spaces* (VSS).

   Floors are 2 h FS; therefore, from Sentence 3.6.3.1.(1) and Table 3.6.3.1., the VSS must be 1 h FS. Fire dampers require 3/4 h FPR. – Sentence 3.1.8.4.(2) → Table 3.1.8.4.

   From Guide 20 I 8.5 (CCN No. EMNOC) (ULC Directory, Building Materials), Nailor Industries Inc. lists ten dampers that can be mounted in a vertical position. All of these dampers have a fire protection rating of 1 1/2 h.

2. At the same locations, consider an air-conditioning duct that is used singly. Identify a manufacturer and a *fire damper* that could be installed in openings of the *vertical service spaces*.

   Fire dampers still require 3/4 h FPR. From Guide 20 I 8.5 (CCN No. EMNOC) (ULC Directory, Building Materials), Nailor Industries Inc. lists 11 dampers that can be mounted in a vertical position that provide a fire protection rating of 1 1/2 h.

3. Under which circumstances are leakage-rated dampers required in non-Subsection 3.2.6. buildings?

   When part of a smoke control system.

Exercise #2

From ULC's Online Directory, read about Firestop Systems at Guide 40 U19 (CCN No. XHEZC). Follow the established procedure to deal with the questions. The facilitator will assign flipchart work. Class discussion will begin in 15 minutes.

1. Define F rating.

   The time that a fire stop system will remain in place in the opening and prevent the passage of flame or the occurrence of flaming on any element of the unexposed side of the assembly during a CAN/ULC-S115 fire test.

2. Define FT rating.

   The time that a fire stop will remain in place to meet the F rating, but additionally does not allow the temperature of any thermocouple on the unexposed side of the assembly to rise more than 181°C above its initial temperature during a CAN/ULC-S115 fire test.

3. Consider Figure M4:2 and select a service penetration system, if the steel conduit has a 75 mm diameter and the cables on either side of the pipe are PVC jacketed and the size and construction of the *building* is determined from Article 3.2.2.57.

   Floor assemblies are fire separations with a 2 h FRR – Clause 3.2.2.57.(2)(b) – Clause 3.1.9.1.(1)(a) → Table 3.1.8.4. indicates that a 1 1/2 h F rating is required: SP55 and SP56 from ULC Directory, Fire Stop Systems and Components.

4. Consider Figure M4:3. You are dealing with the same *building* as in Question #3. Select an acceptable joint fire stop (JF).

   Floor assemblies are fire separations with a 2 h FRR – Clause 3.2.2.57.(2)(b) - Any JF system with an F rating of 2 h would be acceptable; JF65 from ULC Directory, Fire Stop Systems and Components. (Clause 3.1.8.1.(1)(a) fire separation shall be a continuous element).

Exercise #3

You have 20 minutes to prepare yourself for class discussion.

1. Consider that the piping in Figure M4:2 is of *combustible* materials. Select a service penetration fire stop that would be suitable for this location. (The *building* is still regulated by Article 3.2.2.57.)

   Floor assemblies are fire separations with a 2 h FRR. – Clause 3.2.2.57.(2)(b) An SP system requires an F rating of 2 h and a 50 Pa pressure differential rating.

   No service penetration fire stop is listed in the ULC Directory, Fire Stop Systems and Components for multiple, same point, penetrations through fire separations by combustible piping.

   For singular combustible pipe penetrations the ULC Directory, Firestop Systems and Components lists several different systems; e.g., SPC2 for 270 mm Schedule 40 PVC; SPC48 for 50 mm Schedule 40 PVC or CPVC; SPC60 for 150 mm ABS

Exercise #4

Read Subsections 2.3.10. to 2.3.12. of SB-2. Follow the usual procedure. Class discussion begins in 20 minutes.

1. The size, spacing and conditions to allow the duct openings are described at Sentences 2.3.10.(1) and 2.3.11.(1) of SB-2. In the space provided and on the flipchart, write the reference of any requirement that the group does not fully understand. It will be reviewed during class discussion.

   Deal with the questions.

2. Which openings must be protected by *fire stop flaps*?

   Every opening greater than 130 cm² in area, both in combustible construction – Sentence 2.3.10.(2) – and in noncombustible construction – Sentence 2.3.11.(2) of SB-2, where such openings are not protected by thermal protection described in 2.3.10.(2)(b)(combustible construction) and 2.3.11.(2)(b)(noncombustible construction).

3. Can a *fire stop flap* substitute for a *fire damper*?

   No. Fire stop flaps and fire dampers are unique and cannot be substituted for one another. Fire dampers are tested to CAN/ULC-S112 – Building Code Sentence 3.1.8.4.(1) – and fire stop flaps to CAN/ULC-S112.2 – Sentence 3.1.9.5.(2).

4. In a generic assembly, is the *fire stop flap* a listed component?

   Yes. Because they are required by the Code to conform to CAN/ULC-S112.2, they would be listed and labelled.

5. In *combustible construction*, how would you treat duct openings of 130 cm²?

   Include them in the calculation of openings versus ceiling area of the fire compartment. – SB-2 Clause 2.3.10.(1)(c)

   See that each opening is spaced not less than 2 m from another opening. – SB-2 Clause 2.3.10.(1)(g)

   Provide fire stop flap or thermal protection as described in Clause 2.3.10.(2)(b) of SB-2.

6. In *noncombustible construction*, what percentage of the ceiling area in a *fire compartment* can be made up of duct openings?

   2% – SB-2 Clause 2.3.11.(1)(b)

7. In *noncombustible construction*, what is the minimum spacing between duct openings in a ceiling membrane?

   At least 2 m – SB-2 Clause 2.3.11.(1)(d)

Exercise #5

We will now deal with a *listed* assembly. First, read about air-handling systems under Guide 40 U18 (CCN No. BXUVC), and ceiling *fire stop flap* assemblies at Guide 40 U18.2W (CCN No. CABSC) in ULC's Online Directory, Fire Resistance. Then examine Figure M4:4. It is a reflective ceiling plan of a floor-and-ceiling assembly associated with ULC Design No. I217 (Figures M4:4a, M4:4b). You have 20 minutes to deal with the questions.

1. Evaluate the area and distribution of air-duct openings.

   The area of duct openings (0.6 m × 0.6 m = 0.36 m²) is acceptable. Individual duct openings are less than the maximum area of 0.37 m² and have dimensions of under 760 mm.

   The total area of;
   (2 × 0.36 m²) / 45.36 m² = 0.16 m² / 10 m² < 0.4 m² / 10 m²
   is also acceptable; Item 10 of Design I217 allows up to 0.4 m² of duct openings in a 10 m² area of ceiling.

2. In the case of Design No. I217, why can the size and distribution of openings for ducts vary from the requirements of Article 2.3.11. of SB-2?

   The assembly was tested in accordance with CAN/ULC-S101 and complies with the rating shown.

Sentence 3.2.2.70.(2) permits the combustible canopy. Sentence 3.1.10.7.(2) prohibits any combustible projections within 2.4 m of a combustible projection, window or door opening of an adjacent building when separated by a firewall. The wood canopy must be set back (North) to at least 2.4 m from the wood fascia sign and window opening #3 of fire compartment No. 2. – Sentences 3.1.10.7.(2) and 3.2.3.6.(1)

The 2012 Building Code added conditions for roof soffits. Where the exposing building face has a limiting distance of not more than 0.45 m, projecting roof soffits shall not be constructed above the exposing building face. – Sentence 3.2.3.6.(2)

Where the exposing building face has a limiting distance of more than 0.45 m, the face of roof soffits above the exposing building face shall not project to less than 0.45 m from the property line. – Sentence 3.2.6.2.(3)

Where roof soffits project to less than 1.2 m from the centre line of a lane or public thoroughfare or from an imaginary line between two buildings or fire compartments on the same property, they shall,

a) have no openings, and

b) be protected by,

   i) not less than 0.38 mm thick sheet steel,

   ii) unvented aluminum conforming to CAN/CGSB-93.2-M, "Prefinished Aluminum Siding, Soffits and Fascia, for Residential Use",

   iii) not less than 12.7 mm thick gypsum soffit board or gypsum ceiling board installed according to CSA A82.31-M, "Gypsum Board Application",

   iv) not less than 11 mm thick plywood,

   v) not less than 12.5 mm thick OSB or waferboard, or

   vi) not less than 11 mm thick lumber.
   – Sentence 3.2.6.2.(4)

For buildings of combustible construction, materials installed to provide the required protection of soffits may be covered with a combustible or noncombustible finish material.
– Sentence 3.2.6.2.(5)

4. In your own words, explain the sprinkler requirements for Article 3.2.8.7. for the *building* illustrated in Figure M4:8.

Every storey of this building must be sprinklered. – Sentence 3.2.8.7.(1) Any flow of water in the sprinkler system must trigger a signal to the fire department by way of the municipal fire alarm system, or by way of a central station conforming to CAN/ULC-S561, "Installation and Services for Fire Signal Receiving Centres and Systems", and the sprinkler system must be electrically supervised by a fire alarm system as described in Sentence 3.2.4.10.(3). – – Sentence 3.2.8.7.(2)

5. Clause 3.2.4.1.(2)(c) requires that this *building* have a fire alarm system because it is more than three *storeys* in *building height*. Explain the additional requirements of Article 3.2.8.8.

The fire alarm system must incorporate smoke detectors on the ceiling of each storey in the vicinity of the openings through floor assemblies, which must additionally activate the smoke control system. – Clause 3.2.8.8.(1)(b) They must be designed to transmit an alert / alarm signal to the fire department by way of the municipal fire alarm system, or a central station conforming to CAN/ULC-S561. – Clause 3.2.8.8.(1)(c)

6. A *building* containing an *interconnected floor space* requires a smoke control system conforming to the requirements of Sentences 3.2.8.9.(2) to (8), to control the movement of smoke within the *building*. Describe the smoke control system for the *building* in Figure M4:8.

The design of the smoke control system is based on the 2.5% January design temperature (outlined in Table 1.2 of Supplementary Standard SB-1). – Sentence 3.2.8.9.(2) The system is started by activation of the sprinkler system or from a signal by at least two smoke detectors in the same zone and located in the IFS. – Sentence 3.2.8.9.(3) The smoke control system shall stop regular exhaust or recirculating fans serving the IFS. – Clause 3.2.8.9.(3)(a); Clauses 3.2.8.9.(3)(b), (c) and (d) do not apply to this building.

The application of Sentence 3.2.8.9.(4) is optional; the building may be designed with zoned air extraction and supply capable of exhausting at the rate of six air changes per hour with sufficient supply air to prevent smoke from passing from the fire floor to other parts of the IFS.

5. For a 22.5 m² EBF with an LD of 3.43 m, a maximum UO of 33.315% of the EBF is permitted. Therefore, the maximum permitted area of unprotected openings is:

   33.315% x 22.5 m² = 7.5 m²

6. Determine whether the openings are protected with wired glass in fixed steel frames, which would permit factoring (doubling) of the maximum percentage of unprotected openings. (Sentence 3.2.3.12.(1))

   The area of UO cannot be doubled, because the openings are not protected with wired glass in fixed steel frames.

2. Consider the *building* described in Question #1 with the following additional information:

   - Window in EBF of 2.3 m x 2.0 m (each compartment)
   - Door "A" in EBF of 0.914 m x 2.4 m (each compartment)
   - Door "B" in EBF of 0.914 m x 2.4 m protected by a ¾ h rolling steel type *closure* by Alpine Overhead Doors Inc (ULC Directory, Building Materials, CCN No. GSNVC) with a fictitious temperature rise on the unexposed side of 600°C (each compartment)
   - The EBF has a *fire-resistance rating* of not less than 3/4 h (200 mm Type S concrete block with an equivalent thickness of 106)

   Does the Building Code permit this arrangement?

   Note: SB-2 tells us that the fire-resistance ratings for walls, floors, roofs, columns and beams found in Section 2 are based on CAN/ULC-S101.

   The CAN/ULC-S101 standard requires assemblies to meet a temperature rise limitation on the unexposed side.

   Guide 120 ID0 (CCN No GSNVC) of ULC's Directory, Building Materials, informs us that labelled assemblies that do not show temperature rise are for doors which develop temperature rises in excess of 250°C during the first 30 minutes of fire exposure.

   Also under the heading "Rolling Steel Type", we are informed that the fire door label does not reference temperature rise. As well, the maximum area of opening is limited to 13.4 m² with no dimension exceeding 3 660 mm.

For the Wall:
For a maximum allowable percentage of unprotected openings of 33.315%,

Table 3.2.3.7. Column 3 tells us that the EBF shall have a fire-resistance rating of not less than 3/4 h

Sentence 3.1.7.1.(2) permits an assembly to be assigned a fire-resistance rating on the basis of the SB-2. Subsection 2.1.1. of SB-2 directs us to Table 2.1.1. to determine the applicable rating for unit masonry. From Table 2.1.1. we see that an equivalent thickness of 106 mm will provide at least a 1.5 h fire-resistance rating.

For the percentage of unprotected openings:

In Question #1 we calculated that the maximum allowable percentage of unprotected openings was 33.315%. Which is equal to 7.5 m^2.

For the unprotected door "A"and unprotected window we have a total area of
2.4 × 0.914 + 2.3 x 2.0 = 6.79 m^2,

But, for the protected door "B" we must calculate an equivalent area of unprotected opening to account for the fact that the rolling door does not meet the temperature rise criteria on the unexposed side. From Sentence 3.2.3.1.(9) we calculate:
$F_{EO} = (T_U + 273)^4 / (T_e + 273)^4$
$= (600 + 273)^4 / (892 + 273)^4$
$= 0.3153$
and
$A_C = A + (A_F \times F_{EO})$
$= 6.79 + ((2.4 \times 0.914) \times 0.3153) = 7.48\ m^2$

This is acceptable since the maximum allowable area of unprotected openings is 7.5 m^2 for each compartment.

3. If the *limiting distance* was less than 1.2 m and all the openings in the *building* described in Question #1 were protected by the *listed* rolling steel door described in Question #2, would the Code permit the openings?

3. Describe the construction of the *exposing building face*.

The building is permitted to be of combustible construction.
– Sentence 3.2.2.27.(1)

1. LD = 4 m;
   response time < 10 min.
2. EBF = 3 x 20 = 60 m²
   L/H ratio: 20/3 = 6.7:1;
   therefore use 3:1 to 10:1
3. A2 occupancy
4. Use Table 3.2.3.1.D. to arrive at the maximum allowable percentage of UO, since the building is sprinklered

For LD of 4 m and EBF of 60 m²; the area of UO permitted is 50% of the EBF

The EBF must have an FRR of 3/4 h – Table 3.2.3.7.

The 2012 Building Code permits the cladding to be non-combustible where the maximum permitted area of unprotected openings are more than 10% where the wall assembly complies with the requirements of Sentences 3.1.5.5.(1),(3) and (4) when tested with CAN/ULC-S134.
– Sentences 3.2.3.7.(1) and (3)

Exercise #5

Read Article 3.2.3.14. and put into your own words what it says. Class discussion will begin in 10 minutes.

Not considering exit facilities and noncombustible walkways used only as a pedestrian thoroughfare that is not required as an exit: Where an unprotected opening in an exterior wall of a fire compartment is exposed to an unprotected opening in the exterior wall of another fire compartment and the planes of the two walls are parallel or at an angle less than 135°, the unprotected openings must be separated by a minimum distance called D_O.
– Sentence 3.2.3.14.(1).

The exterior wall of each fire compartment within D_O must have a FRR equal to that of the interior vertical fire separation required between the fire compartment and the remainder of the building.
– Sentence 3.2.3.14.(2)

4. From Table 3.2.3.1.B., 13% of the EBF is permitted to be UO for an LD of 2.5 m.

2. Determine the construction of the *exposing building face*.

   1. LD = 1.5 m;
      response time < 10 minutes
   2. Area of EBF:
      150 m² (Same as Question #1)
      L/H ratio: > 10:1
   3. Group A occupancy
   4. To determine construction of the EBF, UO of 8% are permitted by Table 3.2.3.1.B. for an LD of 1.5 m.

   Using 8% UO, the South and East elevations are required to be of noncombustible construction, with 1 h FRR and clad with noncombustible cladding. Sentence 3.2.3.7.(1) and Table 3.2.3.7. would override the combustible construction otherwise allowed by Sentence 3.2.2.25.(2).

   The 2012 Building Code permits the cladding to be non-combustible where the maximum permitted area of unprotected openings are more than 10% where the wall assembly complies with the requirements of Sentences 3.1.5.5.(1),(3) and (4) when tested with CAN/ULC-S134, Sentences 3.2.3.7.(1) and (3) With 8% UO Sentence 3.2.3.7.(3) could not be used and the EBF would be required to be non-combustible.

   In addition the 2012 Building Code also permits cladding of the exposing building face to be non-combustible where the area of unprotected openings is more than 25% but not more than 50% of the exposing building face under conditions listed in Sentence 3.2.3.7.(5).

LD for 30% UO:

Sentence 3.2.3.1.(11) permits the LD to be measured to a point beyond the property line that is not the centre line of a street, lane or public thoroughfare if the owners of the property on which the LD is measured and the municipality enter into an agreement as specified in Clause 3.2.3.1.(11)(a) and the agreement is registered on title.

EBF = 150 m²
L/H ratio > 10:1
%UO = 30
LD = ?

For a Group A building that is not sprinklered use Table 3.2.3.1.B.

From Table 3.2.3.1.B. for 4 m LD we get 24%, and for 5 m LD we get 31%. We must extrapolate to determine the required LD that corresponds to 30% UO.

=[(5 m – 4 m)/(31% - 24%)]
x (30% - 24%) = 0.86 m

Therefore the LD must be at least equal to
4 + 0.86 = 4.86 m.

The agreement will reference a distance of 4.86 - 2.5 = 2.36 m on the adjacent property.

5. Consider the *building* in Figure M5:5. What is the maximum area of each individual unprotected opening in the exposing building face and the distance between the individual openings?

LD = 1.2 m
EBF = 150 m²

Firefighting facilities within 10 minutes

No sprinklers

Where the limiting distance is 2 m or less the area of each individual unprotected opening in an exposing building face to comply with Table 3.2.3.1.A .

From Table 3.2.3.1.A the maximum area of individual unprotected openings is 0.35 m².

There are two individual openings in the exposing building face. The distance between is a minimum of 2 m horizontally for a single room or space. – Sentences 3.2.3.1.(6) and (7)

