

S M O K E C O N T R O L S Y S T E M S I N H I G H - R I S E B U I L D I N G S



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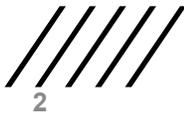


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Agenda

- A. What is Smoke Control.
- B. Codes related to Smoke Control and Design Guide.
- C. Applicable Buildings for Smoke Control – What buildings considered (High-Rise) per OBC.
- D. Common Requirements to ALL Measures for Fire Safety in High Rise Building
- E. OBC VOL.2, SB-4 Measures for Fire Safety in High Buildings
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 - 2. Measure B & C Open Corridor Access to Stairs and Elevators
 - 3. Measure D & E Protected Vestibules Access to Stair & Elevator Shafts
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 - 8. Measure L Area of Refuge (smoke free areas)
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- F. Smoke Control System Testing Requirements





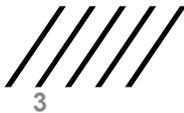
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What is Smoke Control.

"Smoke control" in the broadest sense simply means controlling the movement of smoke throughout a building via passive and active means. The installation of fire and smoke barriers with protected openings is a form of passive smoke control.

Smoke control system is a combination of mechanical and electrical components that control the movement of smoke during a fire event, most is intended to protect occupants while they are evacuating and aiding Firefighter to safely suppress the fire.





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What is Smoke Control (continues...)

Experience with high buildings has demonstrated that the time required for the complete evacuation in the buildings can exceed that which is considered necessary for the safe egress of all occupants. Studies of “chimney effect” and observations of smoke movement in fire condition have shown that measures for containing a fire on a lower story will not always prevent the movement of smoke through the elevator shafts to upper storeys of a high building.





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Codes related to Smoke Control and Design Guide

1. Part 3, Division B of OBC, section 3.2.6 “Additional Requirement for High Buildings”,
2. Supplementary Standard SB-4 “Measures for Fire Safety in High Building” of OBC,
3. Part 7, Division B of OFC, section 7.3. “Inspection, Testing and Maintenance of Smoke Control Equipment”,
4. Commentary C of NRC, User’s Guide – NBC 1995 “Fire Protection Occupant Safety and Accessibility Part 3, and
5. Part 7, Division B of NFC, section 7.3 “Inspection, Testing and Maintenance of Smoke Control Equipment”.





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Applicable Buildings for Smoke Control (High Building)

Part 3, Division B of OBC, section 3.2.6.1 identify high buildings as follows:

- a) Group A, D, E or F *major occupancy* classification that is more than,
 - i. 36 m high, measured between *grade* and the floor level of the top *storey*, or
 - ii. 18 m high, measured between *grade* and the floor level of the top *storey*, and in which the cumulative or total *occupant load* on or above any *storey* above *grade*, other than the *first storey*, divided by 1.8 times the width in metres of all *exit* stairs at that *storey*, exceeds 300,





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Applicable Buildings for Smoke Control (High Building), continues..

- a) containing a Group B *major occupancy* in which the floor level of the highest *storey* of that *major occupancy* is more than 18 m above *grade*,
- b) containing a *floor area* or part of a *floor area* located above the third *storey* designed or intended as a Group B, Division 2 or 3 *occupancy*
- c) containing a Group C *major occupancy* in which the floor level of the highest *storey* of that *major occupancy* is more than 18 m above *grade*, or
- d) containing a *retirement home*, where the floor level of the highest *storey* of the *retirement home* is more than 18 m above *grade*.



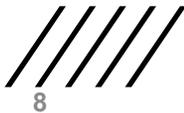


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Common Requirements to ALL Measures for Fire Safety in High Rise Building

1. Elevators controlled by key switch.
2. Elevator for firefighters' requirements.
3. Means of venting each floor each area to outdoor by smoke shaft, window or building exhaust system.
4. Certain floor area of a building to be sprinklered.
5. Limits on flame-spread rating and smoke developed classification for interior finishes materials in certain locations.





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Common Requirements to ALL Measures for Fire Safety in High Rise Building (continues..)

6. Fire alarm system certain requirement “Central alarm and Control facility – CACF” requirements.
7. Voice communication required if building is more than 36m high.
8. Fire protection required for electrical feeders to emergency equipment.
9. Power to operate emergency lighting, fire alarm and voice communication systems.
10. Emergency power to operate elevator required if building is more than 36m high.





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OBC VOL.2, SB-4 Measures for Fire Safety in High Buildings

SB-4 is a supplementary standard for fire and life safety system in high building, SB-4 list measures (techniques) that can be adopted in a building to comply with high building safety requirements, these measure are as follows:

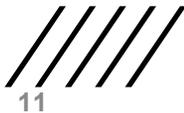


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Measures A: Fully Sprinklered Buildings

The steps described in this Measure amount to an adequate smoke control measure, satisfying the requirements of OBC Sentence 3.2.6.2.(2 to 5.1). Reliance is placed on the full sprinkler installation to limit fire spread and hence the generation of smoke





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Measures A: Fully Sprinklered Buildings

- 1- No limit on height.
- 2- A stairway serving upper levels has a vent or door to outdoor at or near the bottom of stair shaft.
- 3- A stairway serving lower levels:
 - a- has a vent or door to outdoor at or near the top
 - b- is enclosed and separated from upper level stairs by a fire separation, and
 - c- is provided with pressurization fan
- 4- Upper stair to be vented to outdoor via a door that:
 - a- has openable area of 0.05 m^2 for every floor not less than m^2
 - b- open directly to outdoor or vestibule leads to outdoor, and
 - c- has a door openable manually and can remain open during a fire.



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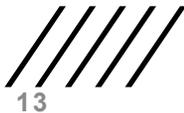
Measures A: Fully Sprinklered Buildings (continues..)

5- Any elevator shaft that goes from upper to lower levels, a vestibule between the shaft and lower level have to be provided for lower levels as described in 3 of Measure D.

6- A vertical service space other than elevator shaft that passes through upper and lower levels, is provided with tight-fitting or fire stop except where the shaft is vented to outdoor at the top.

7- A supply of air required by sentence 3 is carried in duct (fire protection rated).

8- CACF is provided with additional control for vent opening in 6, stop air handling unit and start lower stairs press. Fans (sentence 3).





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Measures B and C: Open Corridor Access to Stair and Elevators

Measures B and C can be applied to a building where habitable floor areas are approached along access ways open to the outdoors.

Each corridor that provides access to stairs or elevators is permanently open to the outside.

Where shafts enclosing plumbing and electrical services penetrate floor spaces and a decision has been made to use Measure B for control of smoke movement, these shafts should be sealed at least at every fifth storey at a horizontal fire separation and at the floor immediately below the lowest exit storey or have vents to the outside at the top.





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Measures B: Open Corridor Access to Stair and Elevator shaft (including restriction on smoke movement from floor to floor).

No limit on height.

- 1- Stair shaft serving floors below the lowest exit level is separate from stair shaft serving floors above that storey (3 B(3)). Stair shaft serving floors below the lowest exit level is pressurized during a fire emergency (3 B(3)).
- 2- Elevator shaft terminates not lower than the first floor below the lowest exit storey or has elevator vestibules in every storey below the lowest exit storey (3 B(4)).
- 3- Vertical service spaces, other than elevator shafts, provided with firestops at the first floor below the lowest exit storey and at intervals of not more than five storeys or vented to outdoors at top during a fire emergency (3 B(5)).
- 4- Open corridor or balcony providing access to stairs and elevator for fire fighters (3 B(2)).

Elevator shaft and stair shaft heating restrictions.

Air moving fans are stopped during a fire emergency in a system that serves more than two storeys (3 B(6)).

Certain dampers close in air handling ducts during a fire emergency (3 B(8)).





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Measures C: Open Corridor Access to Stair and Elevator shaft (no restriction on smoke movement from floor to floor).

Limited to buildings not more than 75 m high (3.2.6.2(6) prov. 6 sentence 1).

1- Stair shaft serving floors below the lowest exit level is separate from stair shaft serving floors above that storey (3 C(3)).

Stair shaft serving floors below the lowest exit level is pressurized during a fire emergency (3 C(3)).

2- Elevator shaft terminates not lower than the first floor below the lowest exit storey or has elevator vestibules in every storey below the lowest exit storey (3 C(4))

3- Open corridor or balcony providing access to stairs and elevator for fire fighters (3 C(2)).

Elevator shaft and stair shaft heating restrictions.

Air moving fans are stopped during a fire emergency in a system that serves more than two storeys (3 C(5)).

○ Kayaking in Credit River 2015





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Measures D and E: Protected Vestibules Access to Stairs shaft & Elevator Shaft

In Measures D and E movement of smoke through stair shafts and elevator shafts is limited by the provision of vestibules that are either open to the outdoors during a fire emergency or have outdoor air injected into them. Stair shafts are further protected by opening a door to the outdoors at the bottom of the shaft. Where vestibules are protected by the injection of outdoor air, the elevator shaft is provided with a large opening to the outdoors at the bottom.



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Measures D: Protected Vestibules Access to Stairs shaft & Elevator Shaft (including restriction on smoke movement from floor to floor).

No Limit on height.

1-Door to outdoors in each stair shaft is held open during a fire emergency (3 D(7)).

Stair shaft serving floors below the lowest exit level is separate from stair shaft serving floors above that level (3 D(8)).

Stair shaft serving floors below the lowest exit level is pressurized during a fire emergency (3 D(8)).

2- Elevator shaft terminates not lower than the first floor below the lowest exit storey or has elevator vestibules in every storey below the lowest exit storey (3 D(13)).





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Measures D: Protected Vestibules Access to Stairs shaft & Elevator Shaft (including restriction on smoke movement from floor to floor).

3- Shaft containing an elevator for fire fighters is provided with vent to outdoors at bottom during a fire emergency if the vestibule protection is by pressurization (3 D(9)).

4- Vertical service spaces, other than elevator shafts, are provided with firestops at the first floor below the lowest exit storey and at intervals of not more than five storeys or vented to outdoors at top during a fire emergency (3 D(11)).

5- Vestibule is vented to outdoors during a fire emergency or pressurized (3 D(5)).

Vents to vestibules are openable from central control facility if building is more than 36m high (3 D(6)).

Air moving fans are stopped during a fire emergency in a system that serves more than two storeys (3 D(14)).

Certain dampers close in air handling ducts during a fire emergency (3 D(15)).



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Measures E: Protected Vestibules Access to Stairs shaft & Elevator Shaft (no restriction on smoke movement from floor to floor)

Limited to buildings not nor than 75 m high (3.2.6.2(6) provision 6 sentence 1).

1- Door to outdoors in each stair shaft is held open during a fire emergency (3 E(6)).

Stair shaft serving floors below the lowest exit level is separate from stair shaft serving floors above that level (3 E(7)).

Stair shaft serving floors below the lowest exit level is pressurized during a fire emergency (3 E(7)).



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Measures E: Protected Vestibules Access to Stairs shaft & Elevator Shaft (no restriction on smoke movement from floor to floor)

2- Elevator shaft terminates not lower than the first floor below It lowest exit storey or has elevator vestibules in every storey below the lowest exit storey (3 E(10)).

No special protection is provided against smoke for elevator shafts or vertical service spaces other than a shaft containing an elevator for fire fighters.

3- Shaft containing an elevator for firefighters is provided with vent to outdoors at bottom during a fire emergency (3 E (8)).

4- Vestibule is vented to outdoors during a fire emergency or pressurized (3 E(4)).

Vents to vestibules are openable from central control facility if building is more than 36m high (3E(5)).

Air moving fans are stopped during a fire emergency in a system that serves more than two storeys (3E (11)).



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Measures F and G: Pressurized Stairs and Elevator Shafts

Measures F and G are suitable for use in buildings that have central cores containing elevator shafts and stair shafts and in buildings that have a spine corridor. The objective is to inject sufficient air from outdoors to provide air pressures in stair shafts and in one or more protected elevator shafts that will be at least equal to the outdoor air pressure at ground level. Protected elevator shafts may, in addition, be provided with vestibules on each floor in order to reduce the effect of the large leakage areas around elevator doors, which may otherwise require injection of excessive quantities of air in order to achieve the desired pressurization.



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Measures F: Pressurized Stairs and Elevator Shafts
(including restriction on smoke movement from floor to floor)

1- No limit on height.

2- A stair shaft serving storeys above the lowest exit level has
a- a vent or door to the outdoors at or near the lowest exit level of the stair shaft, as described in Sentence (4) of Measure A, except that the vent or door will open when the air supply referred to in Clause (b) is initiated, and
b- Pressurization fan.



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Measures F: Pressurized Stairs and Elevator Shafts (including restriction on smoke movement from floor to floor) continues...

3- A stairway serving lower storeys as described in 3 of Measure A.

4- An elevator shaft that contains an elevator for fire fighters is provided with pressurization fan.

5- Where an elevator shaft referred to in Sentence (4) is provided with a vestibule on every floor, the vestibule enclosure conforms to Sentence (3) of Measure D.



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Measures F: Pressurized Stairs and Elevator Shafts (including restriction on smoke movement from floor to floor) continues...

6- Any elevator shaft that contains an elevator for fire fighters and passes through the floor above the lowest exit storey does not penetrate the floor of the storey immediately below the lowest exit storey, except where each floor area below the lowest exit storey is provided with a vent to the outdoors that

a- has a net area of not less than 0.2 m² for every 1000 m² of floor area,

b- will remain open during a fire emergency, and

c- may be incorporated in the conventional exhaust duct system serving storeys below grade

7- A vertical service space, other than an elevator shaft, is provided with a) a tight-fitting fire stop at the level of the floor immediately below the lowest exit storey and at the level of certain other floors that are fire separations, provided the space between fire stops is not more than five storeys, or b) a vent to the outdoors as described in Sentence (10).



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Measures F: Pressurized Stairs and Elevator Shafts (including restriction on smoke movement from floor to floor) continues...

8- Except as provided in Sentence (9), an elevator shaft, other than a shaft that contains an elevator for fire fighters, is pressurized as described in Sentence (4) [press. fan].

9- The provisions of Sentence (8) are waived for an elevator shaft that serves floor areas below the lowest exit storey and does not penetrate the floor immediately above that storey.



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Measures F: Pressurized Stairs and Elevator Shafts (including restriction on smoke movement from floor to floor) continues...

10- Where a vent to the outdoors is required by Sentence (7) or other provisions of this document, the vent,

a- if it is a vertical service space in a building in which other shafts are not mechanically pressurized, has a certain openable area,

b- if it is in a shaft serving floor areas above the lowest exit storey, is located at or near the top of the shaft where the top of the shaft is above the mid-height of the building, or at or near the foot of the shaft at or near the exit level where the top of the shaft is below the mid-height of the building,

c- if it is in a shaft serving floor areas below the lowest exit storey, is located at or near the top of the shaft, and

d- if it is provided with a closure, is openable both manually and on a signal from a smoke detector located at or near the top of the shaft and by a control device located at the central alarm and control facility.





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Measures F: Pressurized Stairs and Elevator Shafts (including restriction on smoke movement from floor to floor) continues...

11-Except for air moving fans supplying stairs and elevators as provided in Sentences (2) to (4) and, except for exhaust fans in kitchens, washrooms and bathrooms in dwelling units, air moving fans in an air handling system that serves more than two storeys are capable of being stopped as provided in Sentence (14).

12- In an air handling system that is required to shut down by the provisions of Sentence (11), supply, return and exhaust ducts more than 130 cm² in cross-sectional area at the point of entry into a vertical service space are provided with dampers that will close when air moving fans are stopped.



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Measures F: Pressurized Stairs and Elevator Shafts (including restriction on smoke movement from floor to floor) continues...

13- Where a supply of air is required by the provisions of Sentences (2), (3) or (4) or by other provisions of this document, the duct system is installed in a service area conforming to section 3.6 of Div. B. or is otherwise protected against the effect of fresh air intake to the shaft, or to the storey that contains the protected floor area, vestibule or area of refuge that is required to be protected.[i.e. duct has to be 2 h. rated].

14- The CACF is provided with additional controls that are capable of

a- stopping air handling systems and closing dampers in ducts required in Sentences (11), (12) and (13),

b- initiating the mechanical air supply to stairshafts and elevator shafts required in Sentences (2), (3) and (4), and

c- opening closures to vents in vertical spaces where required in Sentence (7).



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Measures G: Pressurized Stairs and Elevator Shafts (no restriction on smoke movement from floor to floor)

- 1- Limited to buildings not more than 75 m high (3.2.6.2(6) provision 6 sentence 1).
- 2- Sentence 2 of Measure F.
- 3- Sentence 3 of Measure F.
- 4- Sentence 4 of Measure F.
- 5- Sentence 5 of Measure F.
- 6- Sentence 6 of Measure F.
- 7- Sentence 11 of Measure F.
- 8- Where a supply of air is required by Sentences (2), (3) and (4), it is carried in ducts as described in Sentence (13) of Measure F.
- 9- The CACF is provided with additional controls that are capable of
 - a- stopping air handling systems and closing dampers in ducts required in Sentences (7), and
 - b- initiating the mechanical air supply to stair shafts and elevator shafts required in Sentences (2) to (4)



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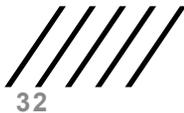


Measures H: Fully Pressurized Buildings

Measure H is appropriate for buildings having central cores that contain stair shafts and elevator shafts and windows that are not normally opened.

The air pressure in the whole building is increased so that at grade level it is at least equal to outdoor air pressure.

When a vent to the outdoors is provided on the fire floor by a window in an exterior wall, by an opening into a smoke shaft as described in Chapter 3 or by the building mechanical exhaust system if the building is sprinklered, the pressure in the floor area is reduced substantially. Air will then flow from the shafts and other floor areas into the fire floor.





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Measures H: Fully Pressurized Buildings

No limit on height.

1- All floor areas are pressurized during a fire emergency (3 H(2)).

Provision for modulating air supply for building pressurization during warm weather (3 H(4)).

2- Fire floor is provided with means of venting to outdoors by smoke shaft or windows (3 H(7)).

3- A proportion of air for building pressurization is directed into stair shafts (3 H(2)).

Doors to outdoors in stair shafts are not held open during a fire emergency (3 H(5))

4- Except as required for venting, all openings in perimeter walls and roof are kept closed during a fire emergency (3 H(5)).

Except as required for pressurization, air moving fans are stopped during a fire emergency in a system that serves more than two storeys (3 H(4)).

Certain dampers in air handling ducts are closed during a fire emergency (3 H(6)).



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Measures I and J: Partially Pressurized Buildings

Measures I and J are very similar to Measure H, except that they may be applied to buildings where windows may be open during normal use. They are thus particularly suitable for controlling smoke movement in residential buildings

The central core, which includes exit stair shafts, elevator shafts and public corridors, is separated from the remainder of the floor areas. It is important that the leakage area of walls around the core be less than that of the exterior walls of the building.





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Measures I : Partially Pressurized Buildings(including restriction on smoke movement from floor to floor outside core)

No limit on height.

1- Enclosing wall of core is a fire separation with self-closing doors
Central core is pressurized during a fire emergency (3 I(2)).

All openings in perimeter walls and roof of core are kept closed during a fire emergency (3 I(3)).

2- Fire compartment is vented to outdoors during a fire emergency by smoke shaft or windows (3 I(4)).





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Measures I : Partially Pressurized Buildings(including restriction on smoke movement from floor to floor outside core)

3- Vertical service spaces, other than elevator shafts, outside core provided with fire stops at the level of the first floor below the lowest exit storey and at intervals of not more than five storeys or vented to outdoors at the top during a fire emergency (3 I(6)).

4- Doors to outdoors in stair shafts are not held open during a fire emergency except as required for pressurizing the core (Chapter 2, Measure I Sentence (3)).

Air moving fans are stopped during a fire emergency in a system that serves more than two storeys (3 I(7)).

Certain dampers in air handling ducts are closed during a fire emergency (3 I(8)).



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Measures J : Partially Pressurized Buildings(no restriction on smoke movement from floor to floor outside core)

Limited to buildings not more than 75 m high (3.2.6.2(6) provision 6 sentence 1).

1- Enclosing wall of core is a fire separation with self closing doors, Central core is pressurized during a fire emergency (Chapter 2, Measure J Sentence (2)).

All openings in perimeter walls and roof of core are kept closed during a fire emergency (Chapter 2, Measure J Sentence (3)).

2- Doors to outdoors in stair shafts are not held open during a fire emergency (3 J(3)).

Air moving fans are stopped during a fire emergency in a system that serves more than two storeys (3 J(4)).



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Measures K: Vertically Divided Buildings

In Measure K a degree of protection for occupants is achieved by providing either a spatial separation or a fire separation between two parts of the building. Under these conditions, except as subsequently noted, air pressures on either side of the division will be symmetrical and smoke should not pass from one side to the other. Smoke from fire in one part of the building may be expected to pass into the stair shafts, elevator shafts and floor areas on the fire side, while the equivalent spaces on the other side will remain smoke free. Vestibules and bridges are provided as means of access to refuge areas for occupants of floor areas in the part of the building that is exposed to fire and smoke.



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Measures K: Vertically Divided (with spatial separation)

No limit on height

1- Door to outdoors in each stair shaft is held open during a fire emergency (3 K(13)).

2- One elevator for firefighters and one stair shaft in each smoke control region (3 K(4)).

3- If bridges do not occur at each storey, two stair shafts are required in each smoke control region (sentence 3.4.2.1. of Div. B).

4- Building designed as two smoke control regions with spatial separation between (3 K(2)).

5- Bridges are provided at intervals of not more than five storeys. except that in buildings of Group C major occupancy more than 75m high, a bridge is provided at each storey (3 K(3)).

Bridges are vented to outdoors or pressurized during a fire emergency (3 K(11)).

6- Fire separation in storeys below grade to maintain separation between smoke control regions (Chapter: Measure K Sentence (15)).

Air moving fans are stopped during a fire emergency in a system that serves more than two storeys (3 K(14)).



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Measures K: Vertically Divided (with fire separation)

No limit on height

1- Door to outdoors in each stair shaft is held open during a fire emergency (3 K(13)).

2- One elevator for firefighters and one stair shaft in each smoke control region (3 K(4)).

If vestibule do not occur at each storey, two stair shafts are required in each smoke control region (sentence 3.4.2.1. of Div. B.).

4- Building designed as two smoke control regions with fire separation between (3 K(2)).

Fire separation in storeys below grade to maintain separation between smoke control regions (3 K(15)).

5- Vestibule is provided at intervals of not more than five storeys, except that in the case of buildings of Group C major occupancy more than 75m high, the vestibule is at each storey (3 K(3)).

Vestibules vented to outdoors or pressurized during a fire emergency (3 K(11)).



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Measures L: Area of Refuge (smoke free areas)

Measure L is intended to provide refuge areas that occupants may enter during a fire. It may be used for buildings that have many openings between floors so that it is impracticable to confine smoke to one floor level.

This measure is basically the same as described in Measure D, except that larger quantities of air must be injected into each area of refuge than into a comparable vestibule in order to maintain tolerable conditions for the occupants. The area of refuge may include normally occupied space in the building, and because fire may occur in one of these spaces, provision is made for alternative groups of areas of refuge.



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Measures L: Area of Refuge (duplicate groups of areas of refuge at every fifth storey except as required in item 5)

No limit on height.

1- Stair shaft and shaft containing an elevator for fire fighters protected by area of refuge or vestibule (3L(11)).

Door to outdoors in each stair shaft is held open during a fire emergency (3L(14)).

Stair shaft serving floors below the lowest exit level is separate from stair shaft serving floors above that storey (3L(15)).

Stair shaft serving floors below the lowest exit level is pressurized during a fire emergency (3L(15)).

2- Stair shaft and shaft containing an elevator for firefighters is protected at intermediate floors by pressurized vestibules (3L(11)).





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Measures L: Area of Refuge (duplicate groups of areas of refuge at every fifth storey except as required in item 5)

3- Shaft containing an elevator for firefighters terminates not lower than the first floor below the lowest exit storey or has elevator vestibules in every storey below the lowest exit storey (3L(13)).

Shaft containing an elevator for firefighters is provided with vent to outdoors at bottom during a fire emergency (3L(16)).

4- No special protection is provided against smoke for elevator shafts or vertical service spaces other than a shaft containing an elevator for firefighters.

5- Two areas of refuge on each fifth floor are pressurized during fire emergency (3L(10)), or areas of refuge staggered on intermediate storeys (see Figure C-15), except that in buildings of Group C major occupancy more than 75m high the areas of refuge are located on each storey.

Air moving fans are stopped during a fire emergency in a system that serves more than two storeys (Chapter 2, Measure L Sentence (18)).



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Measures L: Area of Refuge (areas of refuge located in pairs)

No limit on height.

1- Stair shaft and shaft containing an elevator for firefighters are protected by area of refuge or vestibule (3L(11)).

Door to outdoors in each stair shaft is held open during a fire emergency (3L(14)).

Stair shaft serving floors below the lowest exit level is separate from stair shaft serving floors above that storey (3L(15)).

Stair shaft serving floors below the lowest exit level is pressurized during a fire emergency (3L(15)).

2- Two areas of refuge are pressurized during a fire emergency (see Figure C-14 for area of refuge every fifth storey), except that in buildings of Group C major occupancy more than 75m high, the areas of refuge are located on each storey (3L(10)).





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Measures L: Area of Refuge (areas of refuge located in pairs)

2- Two areas of refuge are pressurized during a fire emergency (see Figure C-14 for area of refuge every fifth storey), except that in buildings of Group C major occupancy more than 75m high, the areas of refuge are located on each storey (3L(10)).

3- No special protection is provided against smoke for elevator shafts or vertical service spaces other than a shaft containing an elevator for firefighters.

4- Shaft containing an elevator for fire fighters terminates not lower than the first floor below the lowest exit storey or has elevator vestibules in every storey below the lowest exit storey (3L(13)).

Shaft containing an elevator for firefighters is provided with vent to outdoors at bottom during a fire emergency (3L(16)).

Air moving fans are stopped during a fire emergency in a system that serves more than two storeys (3L(18)).



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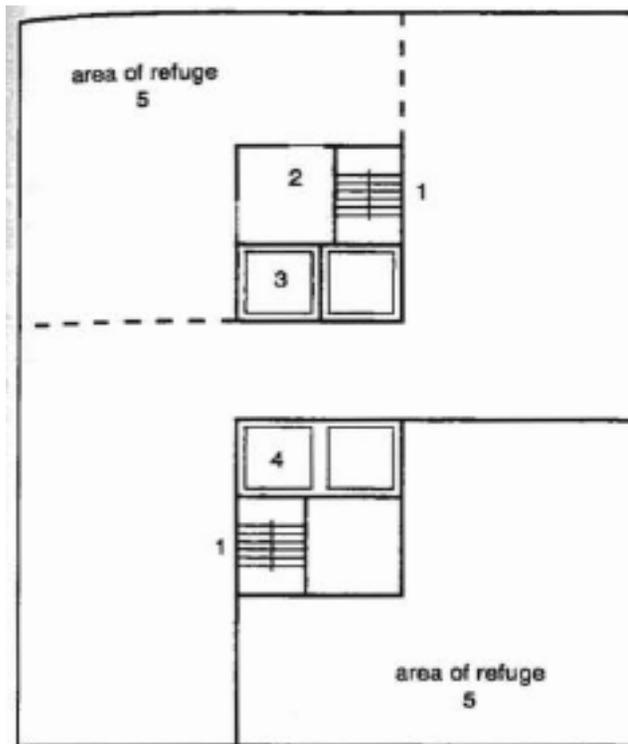


Figure C-14
Typical floor plan, Measure L

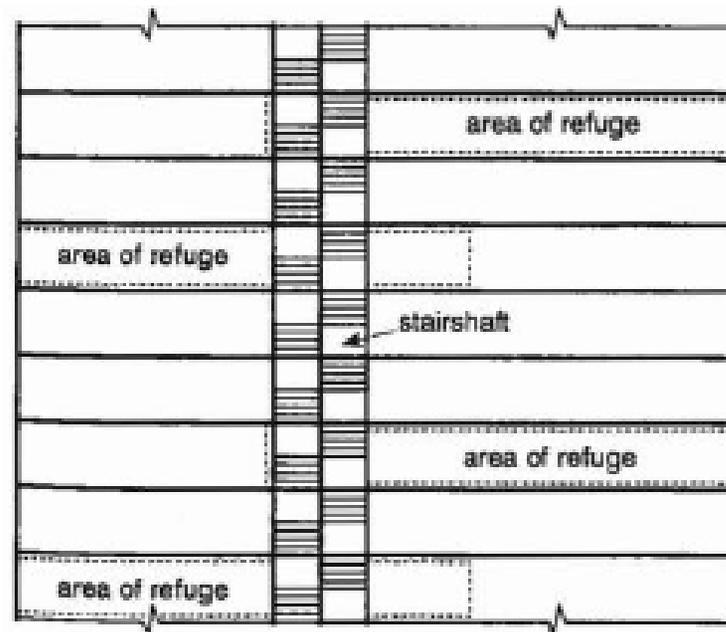


Figure C-15
Typical cross section showing areas of refuge on intermediate floors





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Measures M: Residential Buildings with Balconies

In residential buildings the greater part of the requirements for control of smoke movement are waived where each suite has direct access to a balcony.

The protective features are limited to stopping air handling systems, providing an opening to the outdoors at the foot of stair shafts serving upper floors and protection of stair shafts in storeys below grade.



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Measures M: Residential Buildings with Balconies

- 1- The requirements specific to unsprinklered residential buildings.
- 2- A stair shaft serving storeys above the lowest exit level has a vent or door to the outdoors at or near the bottom of the stair shaft, as described in Sentence (4) of Measure A.
- 3- A stairway serving storeys below the lowest exit level is protected as described in Sentence (3) of Measure A.
- 4- Any elevator shaft that passes through the floor above the lowest exit storey does not penetrate the floor of the storey immediately below the lowest exit storey, except where there is a vestibule between the elevator door or doors and each floor area below grade as described in Sentence (3) of Measure D.



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Measures M: Residential Buildings with Balconies

5- Except for exhaust fans in kitchens, washrooms and bathrooms in dwelling units, air moving fans are stopped during a fire emergency in an air handling system that serves more than two storeys.

6- Where a supply of air is required by Sentence (3), it is carried in ducts as described in Sentence (13) of Measure F.

7- Where CACF is required, will be provided with additional controls that are capable of

a- stopping air handling systems as required by requirements specific to unsprinklered residential buildings, and

b- initiating the mechanical air supply to stair shafts as may be required by Clause (3)(c).



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Measures N: Connected Buildings

The measures described here are intended to prevent movement of smoke from one building to another. They are of particular significance where two buildings of unequal height are joined together.

The techniques suggested are the provision of a large opening to the outdoors in a connecting vestibule so that smoke entering through leakage areas around doors will be vented to the outdoors, or pressurization to maintain a higher pressure in the vestibule than in adjacent spaces as illustrated in Figures C-17 and C-18.



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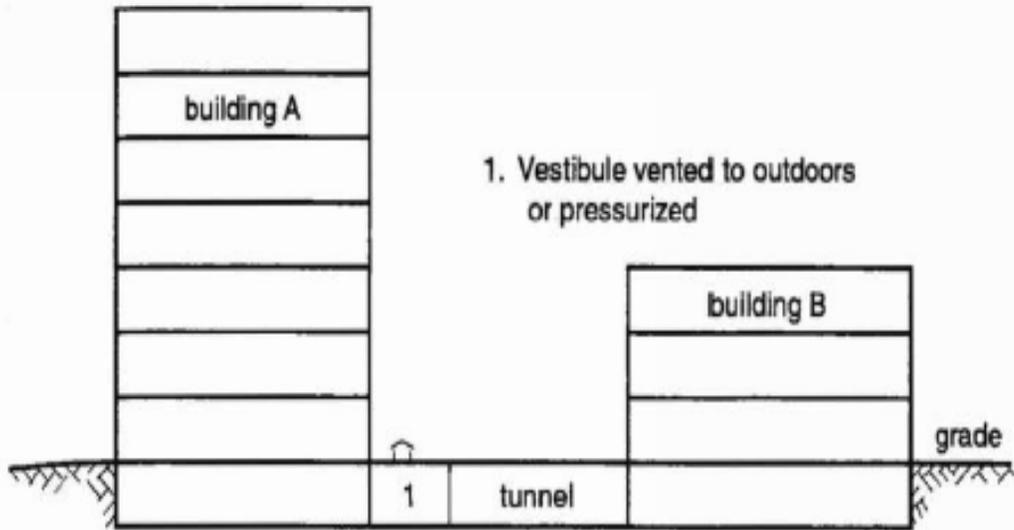


Figure C-17
Section through building linked by underground tunnel

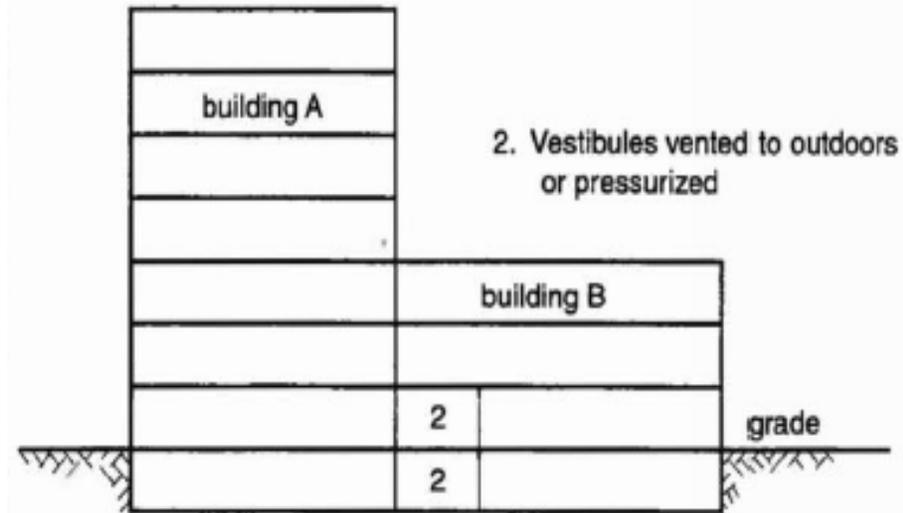


Figure C-18
Section through buildings joined at firewall



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Measures N: Connected Buildings

- 1- The requirement of Sentence 3.2.6.3. of OBC Div. B that limits movement of smoke from one building to another may be met by incorporating in the link between the buildings the requirements in Sentences (2) and (3), below.
- 2- Between one building and the other is a firewall as described in Subsection 3.1.10. of OBC Div. B.



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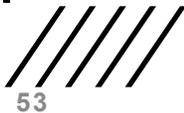


Measures N: Connected Buildings

3- Any opening in the firewall is protected against passage of smoke by a vestibule described in Sentence (3) of Measure D and has

a- a vent to the outdoors that has a certain requirements, or

b- equipment capable of maintaining a supply of air into the vestibule sufficient to ensure that the air pressure in the vestibule when the doors are closed is higher by at least 12 Pa than that in adjacent floor areas when the outdoor temperature is equal to the January design temperature on a 2.5% basis.





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Smoke Control System Testing Requirements:

The Ontario Fire Code (OFC) Part 7 of Division B mandate the checking, inspection, testing and maintenance of Fire Emergency System in a high building.

Section 7.3 is for inspection, testing and maintenance of Smoke control system.



Smoke Control OFC – Subsection 7.3.1 General:

7.3.1.1 Smoke control equipment shall be maintained in a manner that ensures that it is fully operational.

7.3.1.2 Reference in the NRC and National Building code of Canada “smoke control measures”.

7.3.1.3 (1) Subject to Sentences (2) to (5), where a smoke control system is designed to meet the requirements of the Building Code, the inspections and tests for equipment shall be carried out in accordance with procedures established by the designer of the system.



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Smoke Control OFC – Subsection 7.3.1 General:

(2) Where procedures described in Sentence (1) are not available, smoke control systems shall be assessed to ensure satisfactory operation using techniques described in MAH Supplementary Standard SB-4, “Measures for Fire Safety in High Buildings”.

(3) Upon completion of the assessment described in Sentence (2), written procedures for periodic inspections and tests shall be established.

(4) The procedures described in Sentence (3) shall bear the signature and seal of a **Professional Engineer or Architect**.

(5) The inspections and tests established under Sentence (3) shall be implemented.



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Any Questions



End of the Presentation



Any Questions