

# Ventilation System Design Guide

For Dwellings With

8 or Less

Developed Rooms

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MUNICODE SERVICES LTD.

## **VENTILATION REQUIREMENTS** **UNDER THE 1995 BUILDING CODE**

While care has been taken to ensure that the information in this manual conforms to the 1995 National Building Code and the Uniform Building and Accessibility Standards Act, MuniCode Services Ltd. does not assume responsibility for errors or omissions in this publication, nor for specifications or work based on it.

### **Basic Requirements:**

MuniCode is to be contacted once a ventilation system is chosen from the options included in this guide. If a ventilation system not described in the following options is installed, then a ventilation worksheet at the back of this guide is to be completed and submitted for review.

### **Total Ventilation Capacity:**

The Building Code requires every home, with the exception of some summer cottages to have a minimum amount of mechanical ventilation. This will be determined based on the number of rooms in the home. The total ventilation capacity is provided by a principal exhaust system and a supplemental exhaust system.

### **Principal Exhaust Capacity:**

This is the air flow exhausted by the principal exhaust fan sized to provide between 50% and 75% of the total ventilation capacity. This system must be designed to run continuously although a provision must be made with a manual switch so the home owner can shut it off.

### **Supply Air Capacity:**

The code requires air from outside to be brought into the dwelling in order to maintain a balanced air pressure within the dwelling. This ensures moisture is not pushed into the exterior walls, windows, or doors causing potential mould build-up and eventual deterioration of the dwelling. Typically this is achieved by providing an insulated fresh-air duct connecting to the return-air plenum and then interconnecting the furnace circulation fan with the principal exhaust fan. Another option is to install an air-to-air exchanger, which will supply fresh-air into the dwelling while also providing the required principal exhaust. For dwellings without a forced-air heating system or an air-to-air exchanger, a supply fan must be installed.

### **Supplemental Exhaust Capacity:**

Since the principal exhaust capacity can only be between 50% and 75% of the total ventilation capacity, additional exhaust is required to achieve the total ventilation capacity. This additional exhaust is the supplemental exhaust and is usually provided by installing a kitchen range hood and/or a bathroom exhaust fan. These fans run independent of the supply air capacity and are designed only to run when needed so that their use will not depressurize the dwelling.

## Additional Ventilation Requirements

- Exterior fresh-air intake hoods:
  - Fresh-air intake hoods are to be clearly labelled.
  - Fresh-air intake hoods are to be protected with a screen to prevent the entry of rodents and birds.
  - Fresh-air intake hoods are to be at least 900 mm (36") from any potential source of contaminants such as gas vents, exhaust hoods and appliance vents.
  - Fresh-air intake hoods are to be at least 450 mm (18") from the ground or the depth of expected snow accumulation, whichever is greater.
  
- Exterior exhaust hoods:
  - Exhaust hoods shall have a backdraft damper, unless the hood is serving an air-to-air exchanger.
  - Exhaust hoods are to be at least 100 mm (4") above the ground.
  
- Make-up air:
  - Make-up air is required for any exhaust device(s) that exhausts more than 75 L/s (160 cfm) such as clothes dryers, central vacuums and large range hoods.
  
- Carbon monoxide (CO) detector:
  - If a wood-burning fireplace or stove is installed that does not have doors which are shut when the fireplace or stove is operating then an electrically operated CO detector must be installed on or near the ceiling of that room.
  
- Fresh-air duct:
  - The fresh-air is to be insulated to not less than RSI 0.5. Ducts for air-to-air exchangers have additional insulation requirements.
  
- Rectangular duct sizes:

Required Round Duct Size, mm	Permitted Equivalent Rectangular Duct Size, mm			
	Stack Duct	100 mm depth	125 mm depth	150 mm depth
75	75 x 150	50 x 100	-	-
100	75 x 250	75 x 100	75 x 125	75 x 150
125	75 x 250	125 x 100	100 x 125	100 x 150
150	75 x 300	200 x 100	150 x 125	125 x 150
175	75 x 350	275 x 100	200 x 125	175 x 150
> 175	design to Subsection 9.33.4.			

# Ventilation Design for 8 or Less Developed Rooms

## Option 1 - Principal Exhaust Draws From the Bathrooms

### Ventilation Overview:

- Principal exhaust fan located in the basement draws from all bathrooms plus any other desired rooms.
- The principal exhaust fan is interconnected with the furnace circulation fan and controlled by a centrally located switch. This switch is to be labelled 'Ventilation Fan'.
- Range hood exhausting outdoors or a separate exhaust fan installed in the kitchen.

### Minimum Total Ventilation Capacity:

- 55 litres/sec (120 cfm)

### A. Principal Exhaust Fan:

- **Fan Size**  
27.5 to 41.25 litres/sec (60 to 90 cfm)  
If larger fan is used it must be controlled down to 24.75 to 30.25 litres/sec
- **Fan Sound Rating**  
Maximum is 53 dBA (2 sones)
- **Fan Duct Sizes**

	<u>27.5 to 35 litres/sec fan</u>	<u>35 to 41.25 litres/sec fan</u>
From intake grill to fan:	4"	5"
From fan to outside hood:	5"	6"

Duct length from the outside hood to the furthest intake grill: 6m to 12m (20' to 40')  
Number of elbows: 2 to 4

### B. Supplement Kitchen Exhaust Fan or Range Hood:

- **Fan Size**  
50 to 75 litres/sec (105 to 158 cfm)
- **Fan Sound Rating**  
Maximum is 60 dBA (3.5 sones)
- **Fan Duct Sizes**  
150 mm (6") for smooth duct or 175 mm (7") for flexible duct  
Maximum duct length: 9m (30')  
Maximum number of elbows: 4
- **Additional Requirements for Kitchen Exhaust Fan**  
Controls for the fan are to be located in the kitchen and separate from the light switch  
Intake to be located in the ceiling or in a wall within 300 mm (12") of the ceiling  
Exhaust duct to be accessible for cleaning unless a grease filter is provided

### C. Fresh Air Supply Duct:

- **Duct Size**  
For exhaust fan sized at 27.5 to 35 litres/sec the supply duct is to be 150 mm (6")  
For exhaust fan sized at 35 to 41.25 litres/sec the supply duct is to be 175 mm (7")  
Maximum duct length: 6m (20')  
Maximum number of elbows: 2

# Ventilation Design for 8 or Less Developed Rooms

## Option 2 - Principal Exhaust Draws From the Kitchen

### Ventilation Overview:

- Principal exhaust fan located in the basement draws from the kitchen only.
- The principal exhaust fan is interconnected with the furnace circulation fan and controlled by a centrally located switch. This switch is to be labelled 'Ventilation Fan'.
- Exhaust fans provided for each bathroom and any other desired room.

### Minimum Total Ventilation Capacity:

- 55 litres/sec (120 cfm)

### A. Principal Exhaust Fan:

- **Fan Size**  
27.5 to 41.25 litres/sec (60 to 90 cfm)  
If larger fan is used it must be controlled down to 24.75 to 30.25 litres/sec
- **Fan Sound Rating**  
Maximum is 60 dBA (3.5 sones)
- **Fan Duct Sizes**

	<u>27.5 to 35 litres/sec fan</u>	<u>35 to 41.25 litres/sec fan</u>
Duct size:	5"	6"

Duct length from the outside hood to the furthest intake grill: 6m to 12m (20' to 40')  
Number of elbows: 2 to 4
- **Additional Requirements for Kitchen Exhaust Fan**  
Intake to be located in the ceiling or in a wall within 300 mm (12") of the ceiling  
Exhaust duct to be accessible for cleaning unless a grease filter is provided

### B. Supplement Exhaust Fans for Each Bathroom:

- **Fan Size**  
25 to 75 litres/sec (55 to 158 cfm)
- **Fan Sound Rating**  
Maximum is 53 dBA (2 sones)
- **Fan Duct Sizes**  
125 mm (5") for smooth duct or 150 mm (6") for flexible duct  
Maximum duct length: 9m (30')  
Maximum number of elbows: 4
- **Additional Requirements for Bathroom Exhaust Fan**  
Controls for the fan are to be located in the bathroom and separate from the light switch  
Ducts are to be reasonably airtight, constructed of a material impervious to water and are to exhaust outdoors

### C. Fresh Air Supply Duct:

- **Duct Size**  
For exhaust fan sized at 27.5 to 35 litres/sec the supply duct is to be 150 mm (6")  
For exhaust fan sized at 35 to 41.25 litres/sec the supply duct is to be 175 mm (7")  
Maximum duct length: 6m (20')  
Maximum number of elbows: 2

# Ventilation Design for 8 or Less Developed Rooms

## Option 3 - Air-To-Air Exchanger Exhausts Bathrooms

### Ventilation Overview:

- Air-to-air exchanger exhausts from the bathrooms plus any other desired rooms.
- The air-to-air exchanger is controlled by a centrally located switch. This switch is to be labelled 'Ventilation Fan'.
- Range hood exhausting outdoors or a separate exhaust fan installed in the Kitchen.

### Minimum Total Ventilation Capacity:

- 55 litres/sec (120 cfm)

### A. Air-To-Air Exchanger:

- **Net Supply / Exhaust Air Flow**

27.5 to 41.25 litres/sec (60 to 90 cfm)

If larger fan is used it must be controlled down to 24.75 to 30.25 litres/sec

The supply and exhaust airflow rates shall vary no more than 10%

- **Exhaust Duct Sizes**

	<u>27.5 to 35 litres/sec fan</u>	<u>35 to 41.25 litres/sec fan</u>
From intake grill to air-to-air:	4"	5"
From air-to-air to outside hood:	5"	6"

Duct length from the outside hood to the furthest intake grill: 6m to 12m (20' to 40')

Number of elbows: 2 to 4

- **Supply Duct Size**

125 mm (5") for smooth or flexible duct

Maximum duct length: 8m (26')

Maximum number of elbows: 3

### B. Supplement Kitchen Exhaust Fan or Range Hood:

- **Fan Size**

50 to 75 litres/sec (105 to 158 cfm)

- **Fan Sound Rating**

Maximum is 60 dBA (3.5 sones)

- **Fan Duct Sizes**

150 mm (6") for smooth duct or 175 mm (7") for flexible duct

Maximum duct length: 9m (30')

Maximum number of elbows: 4

- **Additional Requirements for Kitchen Exhaust Fan**

Controls for the fan are to be located in the kitchen and separate from the light switch

Intake to be located in the ceiling or in a wall within 300 mm (12") of the ceiling

Exhaust duct to be accessible for cleaning unless a grease filter is provided

# Worksheet #1 -Calculating Ventilation Requirements to Conform to 9.32. of the 1995 NBC

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Project Address: \_\_\_\_\_ Municipality: \_\_\_\_\_

Owner's Name: \_\_\_\_\_ Phone #: \_\_\_\_\_

Mechanical Contractor: \_\_\_\_\_ Phone #: \_\_\_\_\_

HRAI #: \_\_\_\_\_

## A) Total Ventilation Capacity

Room	Capacity, L/s
Master Bedroom	10
Other bedrooms	5
Living Room	5
Dining Room	5
Family Room	5
Recreation Room	5
Basement > 2/3 of the floor area	10
Basement < 2/3 of the floor area	5
Other habitable rooms	5
Kitchen	5
Bathroom or water closet room	5
Laundry / Utility room	5

Capacity	No. of Rooms	
5 L/s x		=
10 L/s x		=
<b>Total Ventilation Capacity</b>		<b>1</b>

Remember: -1 bedroom must be designated as the master bedroom  
 -combined rooms (living/dining) shall be considered separately  
 -consider future development

## B) Principal Exhaust Capacity

Minimum Principal Exhaust Capacity =  x 50% = \_\_\_\_\_

Maximum Principal Exhaust Capacity =  x 75% = \_\_\_\_\_

Remember: If the principal exhaust fan rating is greater than Max. PEC, a control is required to make the fan adjustable to +/- 10% of the Min. PEC.

Fan #	Location	Sone	Duct Size / Type	Cap. (L/s)
<b>Principal Exhaust Capacity</b>				<b>2</b>

## C) Supply Air Capacity

\* If the supply air duct is connected to the return air plenum without an additional supply fan, then information for Fan # and Sone is not required.

* Fan #	* Sone	Duct Size	Duct Type	Cap. (L/s)

## D) Supplemental Exhaust Capacity

Remember: -Bathrooms or kitchen not exhausted with the principal exhaust require supplemental exhaust.

-Bathrooms: 25 L/s

-Kitchen: 50 L/s

-Where the principal exhaust fan serves the kitchen and bathroom, an additional supplemental fan is required in the kitchen.

-All supplemental exhaust fans or appliances that exhaust more than 75 L/s require make-up air.

Fan #	Location	Sone	Duct Size / Type	Cap. (L/s)
<b>Supplemental Exhaust Capacity</b>				<b>3</b>

## E) Ventilation System Balance

The Principal Exhaust Capacity + the Supplemental Exhaust Capacity is to be greater than or equal to the Total Ventilation Capacity.

Line 2 + Line 3 ≥ Line 1

\_\_\_\_\_ +  \_\_\_\_\_ = \_\_\_\_\_

# Worksheet #2 -Calculating Ventilation Requirements to Conform to CSA Standard CAN/CSA-F326

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**Note:** A ventilation system conforming to F326 is to be designed and installed by a person(s) experienced with the requirements of F326 or certified by HRAI.

Project Address: \_\_\_\_\_ Municipality: \_\_\_\_\_

Owner's Name: \_\_\_\_\_ Phone #: \_\_\_\_\_

Mechanical Contractor: \_\_\_\_\_ Phone #: \_\_\_\_\_

HRAI #: \_\_\_\_\_

## A) Ventilation Design

Capacity	No. of Rooms	
5 L/s x		=
10 L/s x		=
<b>Required Ventilation by Room</b>	<b>1</b>	

Habitable Space Including Basement		
m <sup>3</sup> /12		=
<b>Required Ventilation by Area</b>	<b>2</b>	

Capacity	No. of Rooms	
Kitchen @ 30 L/s x		=
Bathroom @ 10 L/s x		=
<b>Required Continuous Exhaust</b>	<b>3</b>	

Room	Capacity, L/s
Master Bedroom	10
Other bedrooms	5
Living Room	5
Dining Room	5
Family Room	5
Recreation Room	5
Basement > 2/3 of the floor area	10
Basement < 2/3 of the floor area	5
Other habitable rooms	5
Kitchen	5
Bathroom or water closet room	5
Laundry / Utility room	5

**Design Central Ventilation System Based on:** \_\_\_\_\_ L/s

**Install an Air-To-Air Exchanger**

Yes  No

## B) Ventilation Installation

Actual ventilation capacity: 1) Outdoor Air Supply: \_\_\_\_\_ L/s 2) Exhaust Air: \_\_\_\_\_ L/s

Supply of re-circulated air to each room will be a minimum of: \_\_\_\_\_ L/s

- Required exhaust provided for the kitchen and bathroom(s)  Yes  No
- Furnace fan interconnected with central exhaust fan (if installed)  Yes  No  N/A
- Air flow rates of the air-to-air exchanger within acceptable parameters  Yes  No  N/A
- Make-up air provided where required  Yes  No  N/A
- Pressure increase less than 10 Pa  Yes  No
- Controls provided that are accessible, labelled and capable of adjusting the ventilation rate to less than the minimum ventilation capacity  Yes  No

If "No" to any of above state reason: \_\_\_\_\_