



SPO Maine State Planning Office

Indoor Residential Ventilation

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Agenda

- Title 16 Department of Public Safety
635 (new) Bureau of Building Codes and Standards
- Course time 2 hours
- ASHRAE
- Overview of the Residential Ventilation Code
- Ventilation Requirements 101
- Resources for Information
- Navigating the Code

The New Standard

Title 16 Department of Public Safety
635 (new) Bureau of Building Codes and Standards -
Maine Uniform Building and Energy Code

Chapter 1 Administrative Procedures

Purpose and Scope


- Chapter 1 sets forth procedures for each individual municipality to recognize and where applicable, enforce the MUBEC.

It further explains the code is a compilation of four different codes and four standards, which have been harmonized by identifying and resolving conflicts between the incorporated codes and standards.

Indoor Residential Ventilation Code

- One of the referenced standards is ASHRAE Standard 62.2-2007

Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings



ASHRAE

The American Society of Heating, Refrigerating and Air-Conditioning Engineers

ASHRAE

The American Society of Heating, Refrigerating and Air-Conditioning Engineers

Is a nationally recognized engineering organization whose standards are approved by the American National Standards Institute (ANSI).

ASHRAE

ASHRAE's standards are well known in the energy, indoor air quality, and building codes communities.

Overview of the IRVC

Incorporation by Reference

ASHRAE 62.2-2007 is included in the MUBEC as the adopted standard for ventilation.



Purpose

The standard defines the roles and minimum requirements for mechanical and natural ventilation systems and the building envelope intended to provide acceptable indoor air quality (IAQ) in low-rise residential buildings.

Acceptable IAQ?

There are two ventilation considerations when determining indoor air quality.

1. Minimum required ventilation for the **Occupants**
2. Minimum required ventilation for the **Building**

Scope

This standard applies to spaces intended for human occupancy within single-family houses and multifamily structures of three stories or fewer above grade, including manufactured and modular houses.

The standard does not apply to transient housing such as hotels, motels, nursing homes, dormitories, or jails.

Scope

The standard considers chemical, physical, and biological contaminants that can affect air quality.

Thermal comfort requirements are not included in the standard.

Scope

While acceptable indoor air quality is the goal of the standard, it will not necessarily be achieved even if all requirements are met.

This is primarily due to...

The diversity of sources and contaminants in indoor air and the range of susceptibility in the population.

Scope

While acceptable indoor air quality is the goal of the standard, it will not necessarily be achieved even if all requirements are met.

This is primarily due to...

Because of the many other factors that may affect occupant perception and acceptance of IAQ, such as temperature, humidity, noise, lighting, and psychological stress.

Scope

While acceptable indoor air quality is the goal of the standard, it will not necessarily be achieved even if all requirements are met.

This is primarily due to...

The infiltration of ambient air into the building without first being cleaned.

Cleaning of ambient outdoor air is not required by this standard

Scope

While acceptable indoor air quality is the goal of the standard, it will not necessarily be achieved even if all requirements are met.

This is primarily due to...

Ventilation systems that are not operated and maintained as designed.

Scope

While acceptable indoor air quality is the goal of the standard, it will not necessarily be achieved even if all requirements are met.

This is primarily due to...

The occurrence of high-polluting events.

Scope

The standard does not address unvented combustion space heaters

Ventilation Requirements 101

3 Primary Requirements

There are three primary sets of requirements in the standard and a host of secondary ones.

1. Whole House Ventilation
2. Local Exhaust
3. Source Control

1. Whole House Ventilation

Is intended to dilute the unavoidable contaminant emissions from people, from materials, and from background processes



2. Local Exhaust



Is intended to remove contaminants from those specific rooms, such as kitchens and bathrooms in which sources are expected because of their design or function



3. Source Control

Measures are included to deal with those sources that can reasonably be anticipated to be found in a residence

“The most effective strategy for keeping exposure to undesirable pollutants low is to keep them from being released into the indoor environment in the first place”

Whole House Ventilation

Is intended to bring fresh air into the general environment to dilute the pollutants that cannot be effectively controlled at the source

The standard doesn't...

- The standard does not address specific pollutant levels
- It does not address certain pollutant sources such as unvented combustion space heaters, or contamination migration from polluted buffer zones (garages, etc)
- It doesn't address contamination from outdoor sources or from episodic occupant controlled events such as painting or smoking.



Credit Available?

It also doesn't offer credit for air cleaning or for pollutant detecting devices such as CO alarms or VOC controllers

Resources for Information

Resources for Information

American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

1791 Tullie Circle NE
Atlanta GA 30329
800-527-4723

www.ashrae.org

Resources for Information

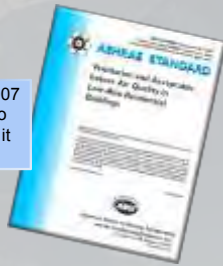
Note the references described in Section 9.
Will review later in this course.

Navigating the Code

Navigating the Code

You're in Luck!

ASHRAE Standard 62.2-2007 is pretty short and sweet, so we should be able to cover it in good detail today!



The Sections

1. Purpose
2. Scope
3. Definitions
4. Whole Building Ventilation
5. Local Exhaust
6. Other Requirements
7. Air Moving Equipment
8. Climatic Data
9. References

All of the Sections in the standard are adopted in the MUBEC

Section 3

Definitions

A Few Important Definitions

Acceptable Indoor Air Quality

Air toward which a substantial majority of occupants express no dissatisfaction with respect to odor and sensory irritation and in which there are not likely to be contaminants at a concentration that are known to pose a health risk

A Few Important Definitions

Air, Indoor

Air in an occupiable space

A Few Important Definitions

Occupiable Space

Any enclosed space inside the pressure boundary and intended for human activities, including, but not limited to, all habitable spaces, toilets, closets, halls, storage and utility areas, and laundry areas.

A Few Important Definitions

Habitable Space

Building space intended for continual human occupancy; such space generally includes areas used for living, sleeping, dining, and cooking but does not generally include bathrooms, toilets, hallways, storage areas, closets or utility rooms.

A Few Important Definitions

Air, Outdoor

Air from outside the building taken into a ventilation system or air from outside the building that enters a space through infiltration or natural ventilation openings

A Few Important Definitions

Air Transfer

Air moved from one occupiable space to another, usually through doorways or grills

A Few Important Definitions

Ventilation

The process of supplying outdoor air to or removing indoor air from a dwelling by natural or mechanical means. Such air may or may not have been conditioned

A Few Important Definitions

Air, Ventilation

Outdoor air delivered to a space that is intended to dilute airborne contaminants

A Few Important Definitions

Conditioned Space

The part of a building that is capable of being thermally conditioned for the comfort of occupants

A Few Important Definitions

Exhaust System

One or more fans that remove air from the building, causing outdoor air to enter by ventilation inlets or normal leakage paths through the building envelope

A Few Important Definitions

Supply System

One or more fans that supply outdoor air to the building, causing indoor air to leave by normal leakage paths through the building envelope

A Few Important Definitions

Heating Degree Day (HDD)

The difference in the temperature between the outdoor mean temperature over a 24 hour period and a given base temperature of a building space

Example: (for heating degree day based on 65 °F) for any one day, when the mean temperature is less than 65 °F, the heating degree days for that day are equal to the difference between the mean temperature and 65 °F

Heating Degree Days

Acceptable Indoor Air Quality

Air toward which a substantial majority of occupants express no dissatisfaction with respect to odor and sensory irritation and in which there are not likely to be contaminants at a concentration that are known to pose a health risk

Heating Degree Days

“A unit of measurement used to define the amount of time the temperature is below 65 °F during each day.”

Heating Degree Days

HDD are determined by adding the high & low temperatures for the day, dividing that number by two and subtracting the result from 65 °F.

Example: Today's high temp = 42 °F
Today's low temp = 10 °F

$$42 + 10 = 52 / 2 = 26. \quad 65 \text{ °F} - 26 = 39 \text{ Heating Degree Days}$$

Why 65 °F? 65 °F is the *balance point* at which indoor heating is no longer needed, due to internal gains. *Internal gain* is heat generated by appliances & occupants.

Heating Degree Days

Heating degree days can also be accumulated to average them over the course of weeks, months or years.

Annual Heating Degree Days are determined by summing all the degree days accrued over the heating season (year).

www.degree-days.net

www.degree-days.net

Month starting -	HDD
3/1/2008	1125
4/1/2008	528
5/1/2008	50
6/1/2008	119
7/1/2008	30
8/1/2008	83
9/1/2008	225
10/1/2008	643
11/1/2008	818
12/1/2008	1270
1/1/2009	1680
2/1/2009	2180
YEAR	2182

“A unit of measurement used to define the amount of time the temperature is below 65 °F during each day.”

A Few Important Definitions

Infiltration

Uncontrolled inward leakage of air through cracks and interstices in any building element and around windows and doors of a building

A Few Important Definitions

Pressure Boundary

Primary air enclosure boundary separating indoor and outdoor air. For example, a volume that has more leakage the outside than to the conditioned space would be considered outside the pressure boundary

Section 4

Whole Building Ventilation

Ventilation Rate

ASHRAE publishes standards in multiple editions, mainly (I-P) and (SI)
[Imperial Units and System International \(metric\)](#)

Your book may show multiple formulas, tables and figures based on these conventions. In the U.S., we will use the (I-P) format.

$$Q_{fan} = 0.01A_{floor} + 7.5(N_{br} + 1)$$

Q_{fan}	Fan flow rate in CFM
A_{floor}	Floor area in square feet
N_{br}	Number of bedrooms; not to be less than one

Let's give it a try...

Example dwelling:

Floor area 2250 square feet
 Bedrooms 4

$$Q_{fan} = 0.01A_{floor} + 7.5(N_{br} + 1)$$

$$2250 \times .01 = 22.5$$

$$5 \times 7.5 = 37.5$$

$$\begin{array}{r} 22.5 \\ +37.5 \\ \hline 60.0 \end{array}$$

Notice the chart is slightly different

Example dwelling:

1501-3000 ft² indicates 75 CFM required

Work the figures for the high and low floor areas

- 1501 ft² and 4 bedrooms = _____
- 3000 ft² and 4 bedrooms = _____

$$Q_{fan} = 0.01A_{floor} + 7.5(N_{br} + 1)$$

Who's moving in???

Section 4.1 is based on the assumed occupancy of two persons in a studio or one-bedroom unit, and one person for each additional bedroom.

In Section 4.1.1, we are required to raise the ventilation rate by 7.5 CFM for each additional person.

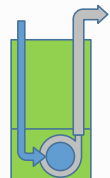
4.2 System Type

The whole house system shall consist of one or more supply or exhaust fans and associated ducts and controls.



Local exhaust fans shall be permitted to be part of the mechanical exhaust system.

Outdoor air ducts connected to the return side of an air handler shall be permitted as supply ventilation if manufacturers requirements for return air temperature are met.

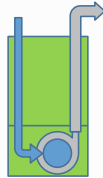


4.2 System Type

We need to keep a few other important considerations in mind...



What is the danger associated with high volume exhaust ventilation in a dwelling with a combustion appliance?



"Outdoor air ducts connected to the return side of an air handler shall be permitted as supply ventilation if manufacturers requirements for return air temperature are met."

4.3

A switch such as the Airetrak Automatic fan control may be installed according to the exception in Section 4.3.



This type of fan control may be adjusted to operate on a timed cycle.

It is also capable of turning any ordinary bathroom fan into a variable speed fan.

These capabilities enable convenient and accurate compliance with whole house ventilation rate requirements.

4.4 Delivered Ventilation

The exception allows an intermittent ventilation system to operate in accordance with the following formula:

$$Q_f = Q_r / (\epsilon f)$$

Q_f	Fan flow rate
Q_r	Ventilation air requirement (from Table 4.1a or 4.1b)
ϵ	Ventilation effectiveness (from Table 4.2)
f	Fractional on time

Try it out...

Example dwelling:	
Floor area	2250 square feet
Bedrooms	4

Our sample house required 60 CFM

Ventilation effectiveness @ 50% fractional on time = .50

Fractional on time = 50%

22.5
+37.5
60.0

$$Q_f = Q_r / (\epsilon f)$$

60 .50 x .50 = .25

60 / .25 = 240 CFM
Min. fan flow required

Section 5

Local Exhaust

5.1

Local mechanical exhaust is required in each kitchen and bathroom.

The local exhaust may be intermittent IAW Section 5.2, or continuous IAW Section 5.3

Local Intermittent Kitchen Exhaust

Try this one out:

Kitchen is 12 x 14, with an 8 foot ceiling

A wall mounted exhaust fan is providing 6060 cubic feet of ventilation air per hour.

Does this fan meet the requirements of the code (purely from a flow perspective)?

Section 6

Other Requirements

6.1

During an inspection of a multi unit building, you notice that wall sconces have been installed on both sides of a common wall between units.

What should you be looking for?

6.4

"... or other code acceptable to the building official."

Building Performance Institute (BPI) is adopted by the State of Maine for energy auditing and conservation, as well as for Combustion Appliance Zone testing.

See www.bpi.org

6.4

"net exhaust flow"

See Section 7.3 with regards to measuring air flow

6.4

"... or other code acceptable to the building official."

Atmospherically vented combustion appliances do not include direct vent appliances

Section 7

Air Moving Equipment

7.4

Multi branch exhaust ducting systems and back flow dampers

Section 8

Climatic Data

IECC Climatic Data

Take note that this Section references IECC 2004 climatic data. The MUBEC has adopted the 2009 IECC codes. The climatic data may be somewhat different.

Section 9

References

Review of References

Indoor Residential Ventilation

Questions?
Comments?
Discussion?

