

Verdugo Fire Academy Ventilation



CSFM Unit L
FFFS Chapter 14



Instructor:
Michael Daoust
Long Beach Fire Department

Ventilation



Ventilation defined:

The planned systematic removal and replacement of heated air, smoke, and toxic gasses from a structure with cooler air.

Ventilation

Effective Ventilation accomplishes 3 important components:

1. Saves lives.
2. Aids Firefighter efforts.
3. Reduces property damage.



Ventilation

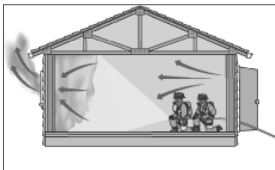
1. Saves lives

Ventilation will draw fire, heat and smoke away from trapped victims giving them a better chance for survival.

Ventilation

2. Aids Firefighter efforts

Firefighters can reach the seat of the fire more quickly and with less physical punishment, also improving opportunity for rescue.



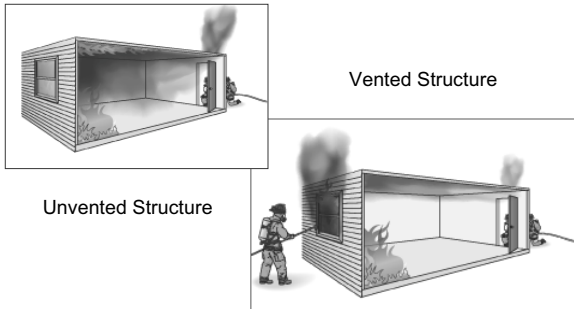
Ventilation

3. Reduces property damage

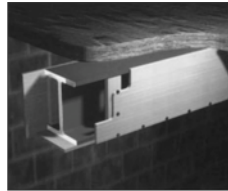
Damage caused by the extension of fire and smoke spread throughout the structure.

Most damage resulting from a structure fire is caused by smoke (#1) and water (#2) damage, not from the actual fire.

Benefits of Proper Ventilation



Ventilation Principles

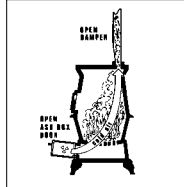


We know from chemistry that things expand when heated.

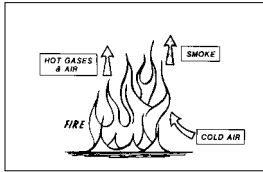
Ventilation Principles

The Potbelly analogy: heated smoke expands and rises by convection past the damper and flows out of the stove in an upward movement, similar to what would happen in a house fire.

Note:
Water expands
1700/1



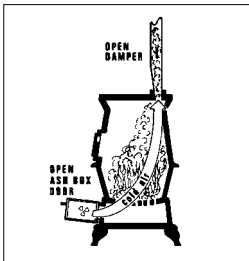
Ventilation Principles



- Fire draws cold Air into the bottom of the fire
- Heated smoke, gases & air rise vertically
- Drawing in air = Free Burning

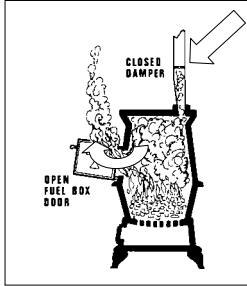
The potbelly stove illustrates vertical ventilation. Under severe conditions, when life and property are significantly jeopardized, aggressive vertical ventilation is a high priority.

Ventilation Principles



Heat and Smoke take the path of less resistance and move up the open damper. The fire draws fresh cool air into itself to complete combustion.
(note: Fire Triangle)

Ventilation Principles

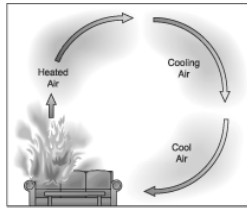


If the damper is closed the smoke will find the most available opening to exit.

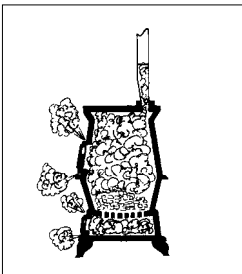
- Cool air drawn in by bottom.
- Rising column of smoke & fire.
- Mushrooming begins.
- Forces Cool air to base.
- Temperatures reach 1,000 °F

Ventilation Principles

- Primary method of fire spread is convection
- Mushrooming occurs when the products of combustion reach the highest point.
- Products of combustion present a risk to fire fighters and occupants.



Ventilation Principles

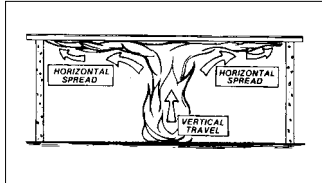


If all openings are closed pressure will build up within the stove (house) waiting for the first available opening.

Fire smolders – no O₂,
The stove fills w/ hot smoke/gases
Temperatures exceed 1,300°F
Stove pressurizes / flammable

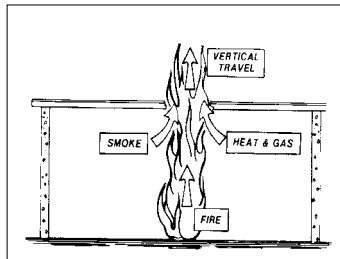
Ventilation Principles

Put the fire in a home with the doors and windows closed as in the potbelly stove and problems begin to mount.



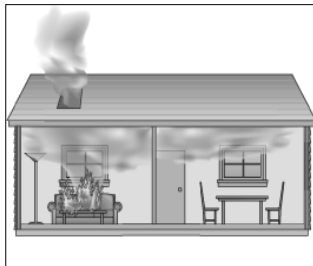
Vertical Ventilation

Vertical ventilation is defined as the removal of heat, smoke and toxic gases by vertical channels.



Vertical Ventilation

By providing a free flow of air into and away from the fire, the conditions of the fire room improve for potential victims and Firefighting efforts.



Horizontal Ventilation

Horizontal ventilation is defined as the removal of heat, smoke and toxic gasses by channeling out of a structure through horizontal openings such as windows and doors.



Horizontal Ventilation

- Most Popular because of Safety/Ease of implementation.
- Does not take advantage of Natural vertical path of gases/smoke
Min. effect on hottest portion or room
- Clears the region around the opening .
BUT has limited potential to prevent a FLASHOVER!



Horizontal Ventilation

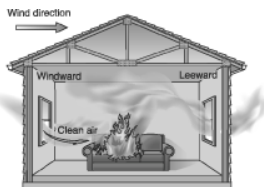
Hydraulic Ventilation utilizes a hose stream to evacuate heat and smoke.



Ventilation Principles

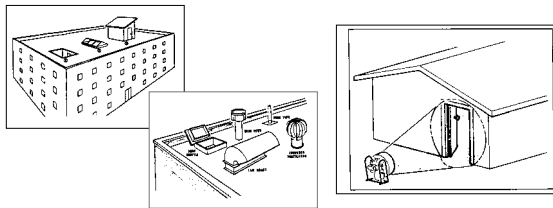
WARNING:

Wind plays an important part in horizontal ventilation and the direction may be stated in reference to the structure as either windward or leeward. The side of the building the wind is striking is windward. The opposite is the leeward.



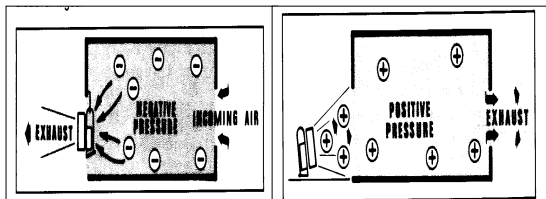
Ventilation Principles

Horizontal and Vertical ventilation can be done by either natural or mechanical means.



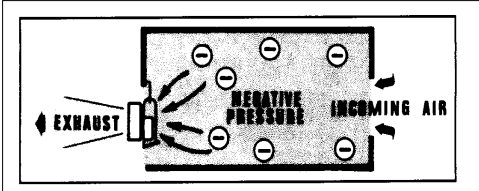
Ventilation Principles

Mechanical ventilation can be done by either negative or positive pressure.



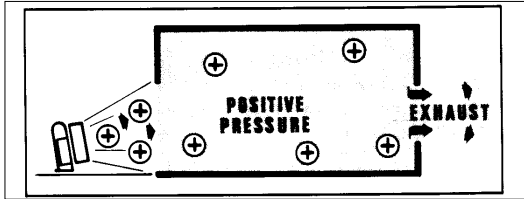
Ventilation Principles

Negative Pressure: the smoke ejector is placed in a structural opening and a negative pressure is created as the heat, smoke and toxic gases are “sucked out of the building”.



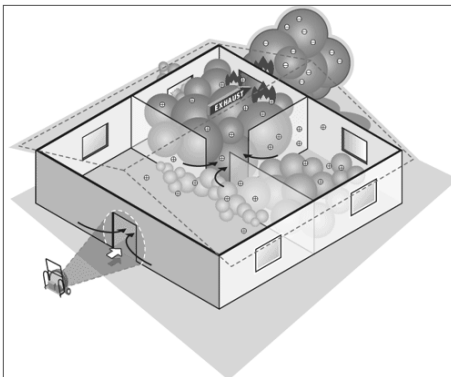
Ventilation Principles

Positive Pressure: the smoke ejector is positioned outside a structural opening and the airflow is directed to force clean, fresh, pressurized air inside the building. (Handout)



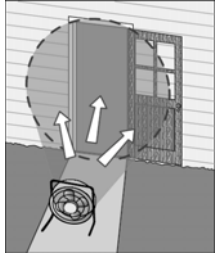
Ventilation Principles

Positive Pressure:



Ventilation Principles

Positive Pressure:



Note: When placing a fan in an opening it is important that the fan spread cover the entire opening. An eddy will be created and smoke will re-circulate back in and out of the structure.

Ventilation

•Structure Considerations



1. Observe/evaluate situation.
2. Is there a need?
 - Have a plan?
 - Which method to use?
3. Extent of Fire.
 - Visible smoke. (color)
4. Location of fire.
5. Building construction.

Ventilation

•Safety equipment



1. Full PPE
2. SCBA
3. Charged hoseline

Note:
Never direct a hose stream into a ventilation opening

Ventilation Cause & Effect



Life hazards to firefighters.

Ventilation Cause & Effect

Life hazards to firefighters



- Roof collapse
- Explosions below
- Extreme smoke conditions
- Escape difficult in emergency

Ventilation Cause & Effect

•Ventilation delayed



- Backdraft
- Roof unsafe
- Entire building involvement
- Excessive property loss
- Increased life hazard

Ventilation Cause & Effect

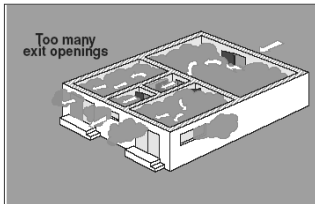
•Opening too soon



- Lines not laid
- Fire gets away
- Increased property loss
- Additional work time
- Additional life hazard

Ventilation Cause & Effect

•Opening wrong place or to many openings



1. No ventilation
2. Spread of fire
3. Increased property loss
4. Additional life hazard
5. Additional work time
6. Public criticism

Ventilation Cause & Effect

•Opening wrong place (continued)



7. Backdraft

- Sudden rapid movement of air inward when opening is made
- Occurs during smoldering phase
- May be indicated by smoke conditions

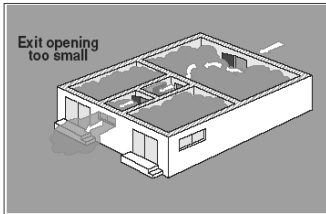
Ventilation Cause & Effect

7. Backdraft or Smoke Explosion



Ventilation Cause & Effect

•Insufficient opening



1. Ineffective ventilation
2. Backdraft
3. Loss of time
4. Additional property loss
5. Additional life hazard

Ventilation cause & Effect

•Opening below the fire



1. Backdraft
2. Increase fire intensity
3. No ventilation
4. No value

Ventilation Hazards

1. Considerations
2. Hazards in closed buildings
3. Roof top ventilation
4. Hoseline placement
5. Safety techniques for all types of ventilation practices

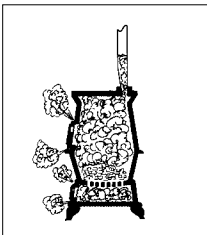
Ventilation Hazards

•Consideration

- | | |
|------------------------------|--|
| 1. Time of day | 5. Composition of fire gases |
| 2. Occupancy | 6. Type of building |
| 3. Probable location of fire | 7. Anticipated action of fire burning freely |
| 4. Contents | 8. Anticipated action of smoldering fires |

Ventilation Hazards

•Hazards in closed buildings



1. Obscurity caused by dense smoke
2. Presence of poisonous gases
3. Lack of oxygen
4. Presence of flammable gases
5. Serious damage to the structure

Ventilation Hazards

- Rooftop ventilation
1. Spongy roof
 2. Secondary means of escape
 3. Lifeline
 4. Sliding and falling
 5. Electrical wires
 6. Protective equipment
 7. Stand to windward side
 8. Weakening structure

Ventilation Hazards

- Hoseline placement
- At no time should a hoseline or elevated stream be directed into a ventilation hole



Ventilation Hazards

- Safety techniques for all types of ventilation practices
1. Provide firm footing on roof
 2. Work in pairs
 3. Provide two means of escape
 4. Hoseline protection
 5. Evacuate roof when ventilation is complete

Ventilation

The planned systematic removal and replacement of heated air, smoke, and toxic gasses from a structure with cooler air.

It is your job to insure that it is safe and effective.
