

Big Tree Volunteer Fire Company, Inc.
Standard Operating Guidelines

Ventilation

Revised June 01, 2001

Purpose:

Proper and timely ventilation of a building on fire is essential to victim and firefighter safety. Proper ventilation can aid in rapid fire extinguishment. However, an improperly or un-ventilated building can result in difficulties in performing search, rescue and fire suppression activities. This guideline describes the various ventilation methods available to firefighters and describes the basic procedures for the preferred methods of ventilating the products of combustion or hazardous air from a structure or confined area.

Definition:

Ventilation is the procedure of providing an outlet for smoke, heat, toxic gases, odors, and other products of combustion from a structure or confined area allowing replacement by fresh air.

Fires, gas build-ups or releases, and hazardous materials incidents are among the several causes of dangerous or undesirable atmospheres that may require ventilation from a structure or confined area.

Proper ventilation at structural fires can prevent flashover and back drafts which are very dangerous to firefighters and occupants. In addition, proper ventilation can preserve property from the effects of heat, smoke, flashover and backdraft.

Methods:

There are various methods of ventilation available to firefighters. These include horizontal, vertical, positive pressure, negative pressure, and hydraulic (hose streams).

Horizontal Ventilating at Structure Fires:

Horizontal ventilation is generally the easiest method and is less time consuming and laborious than vertical venting. Residential structures typically have several windows and doors that can be used to achieve an effective horizontal vent. When horizontally venting via a door or window, if on the first or second floor, it is faster and most often safer to break the window or door from outside the structure rather than from the inside. Firefighters must first determine if a window or door needs to be broken. It is appropriate to create this type of opening if heat and/or smoke conditions inside make it difficult or untenable for interior crews to advance to the seat of the fire to extinguish it or to locate a victim in the building. When visibility is severely impaired for interior crews, a horizontal ventilation opening needs to be made.

There are three factors that are of great importance when ventilating via windows or doors from the outside:

- **Which window to break:**

The preferred window to break is the one that is in the room or area of the fire. This creates an outlet through which the interior hose crew can push the smoke, steam, and heat out of the building. Many times firefighters can determine which window is closest to the fire by looking for a window that is discolored by smoke, cracked by heat, or hot to the touch. However, energy-efficient windows (double insulated or thermal pane) may not give indications of the conditions inside. Communications between the hose-line crew and the vent person may be needed. People who were in the building at the time of the fire may be able to indicate where the fire is. These determinations can be made as part of an initial size-up.

- **When to break the window:**

Once it has been established that a ventilation opening needs to be made and you have chosen which window to break, timing is critical. Removal of the window shall be coordinated with the interior hose crew. The crew will need to have a charged hose-line and be ready to advance into the fire area. Premature ventilating can cause problems that can be detrimental to the outcome of the firefight by increasing the fire's intensity and by pulling the fire into uninvolved areas.

- **How to break a window or door properly and safely:**

It is essential that a proper tool is utilized. A 6 or 12-foot pike pole or hook will generally provide adequate reach to be able to safely break out all of the glass from top to bottom of the window opening. When breaking windows, it is usually safest to stand off to the side and swing the pole in a backhand motion to break the glass. Full protective clothing including gloves and eye protection must be worn. Firefighters should turn their heads away from the window to prevent injury from flying glass. Once all the window glass has been removed, all screens, drapes, curtains, shades, and blinds must be removed to allow the products of combustion to escape unimpeded. Also, any sashes, muntins, and jagged pieces of glass must also be removed. This creates a potential exit point for victims and firefighters that are inside should they need to exit the structure through the ventilation opening.

If conditions inside do not rapidly improve after removing one window or door, additional openings may be required. If an officer is available, they may instruct that additional vent openings be made. If an officer is not readily available to provide directions, firefighters may make additional openings if they feel that the safety and efficiency of the interior crews are still at risk.

Windows should not be broken if the visibility is not hampering the movement or operations of interior crews. Nuisance smoke from burnt food or a small waste paper basket fire usually do not necessitate breaking windows. These types of smoke can often be effectively vented by opening the windows. A rule of thumb is to open the window two-thirds down from the top and one-third up from the bottom.

Ventilating from the Inside:

If personnel are not available to vent from the outside, or if the appropriate windows are not within reach from the ground, a member of the interior crew may need to break windows from the inside. Doing this can help to orient interior personnel to where potential escape routes are and can calm them to some degree. The hazard with this is that often times the interior crews will not have a tool of appropriate length to reach the tops of the windows. This may force firefighters to stand up and reach over furniture and other obstructions to reach the tops of the windows. This may put the firefighter's head and upper body in the very high temperatures that can be present in a burning building.

Vertical Ventilation:

Vertical ventilation occurs by creating an opening above a fire to allow the smoke, heat, steam and toxic gases to escape in an upward direction similar to a chimney effect. While this is a very effective method of venting, there are some drawbacks to accomplishing this method. Vertical ventilation usually requires laddering the building to get crews to the roof. This can be very time consuming to achieve and usually requires additional manpower. In addition, vertical ventilation places firefighters on the roof, which can be a dangerous place to operate depending upon the building construction and fire conditions. If the vent hole is not directly above the fire, the fire will be drawn to the vent hole open, which may spread the fire to uninvolved areas of the building. Typically this method is only effective if the fire is in a one-story building, in the attic space, or in a balloon frame structure with fire in the walls. If the fire is on the first floor of a two-story building, venting the roof on the second floor will do little good to effectively vent the building. Drop ceilings will also need to be knocked down to allow an open path for the smoke and heat to escape.

If assigned to the task of vertically ventilating, firefighters should work in a team of at least two. Caution needs to be taken not to overload a roof with too many firefighters. Removing roof scuttles, roof fan covers, and skylights can be an easy way to achieve a vertical ventilation opening. Keep in mind that if these are not over the fire, the fire can be drawn to these openings. S.C.B.A. should be worn because firefighters are likely to be exposed to IDLH conditions as smoke escapes through the vent hole. On peaked roofs, firefighters should work off of a roof ladder and should make the vent hole as high on the roof as possible. Ideally the hole should be made 4' X 4' and on the leeward side of the peak when possible.

After a vertical ventilation hole has been achieved, firefighters should exit the roof and advise command that the task has been accomplished.

Hydraulic Ventilation:

Hydraulic ventilation can be achieved by use of an interior hose stream. After a fire is knocked down and a ventilation opening is made, directing a partial fog stream (that covers the size of the opening) out the window can be an effective way to move smoke from inside to the outside. The nozzle should be held back about 5 to 6 feet from the window. As the bad air exits the building, good air is drawn in to replace it. When using this method, crews must be aware that smoldering debris can re-ignite as oxygen is fed to it. Fire in other areas of the building can also be drawn to the vent opening. This method is typically used after initial fire knock down has been achieved.

Negative Pressure Ventilation:

Use of an electric exhaust fan is another method of ventilating a building. This method is also typically used after initial fire knock down has been achieved or to exhaust nuisance smoke from burnt food and the like. Exhaust fans can be placed in open doorways and windows. These fans basically suck the bad air out of the building allowing fresh air to rush in to replace the smoky air. An electric power source will be needed to power these fans. Firefighters shall ensure that the airflow path of these fans is not obstructed by window screens, curtains, blinds or firefighters standing in the path of the air flow.

Positive Pressure Ventilation:

Positive pressure ventilation (PPV) is achieved by use of an electric or gasoline powered fan. These fans move a far greater volume of air per minute than do exhaust fans. The basic concept of positive pressure ventilation is that the fans are placed outside of the building with air flow directed into a doorway or window from about 6 feet away. The fan creates a cone of air that should cover the door or window opening so as to force fresh air into the building. As air is forced into the building, it positively pressurizes the building much like blowing up a balloon. For this positive pressure to occur and continue, the size of the open for the bad air to escape must be no bigger than the inlet opening. Firefighters must be able to control the openings in the building to achieve an effective ventilating process. If many windows have been broken, vent hole(s) cut into the roof, or windows that are opened to screens as they typically are in the warmer months in the northeast part of our country, achieving positive pressure is very difficult. PPV can be used during initial fire attack; however, there are many elements that must be place for it to be both effective and safe for firefighters and victims. Firefighters must know where the fire is, have hand-lines deployed, and be well versed and proficient in the use of PPV for it to be used during initial fire attack. Because we cannot always count on these elements, as a general rule, PPV should be used to ventilate a building only after fire control has been achieved. Other drawbacks to the use of PPV are that they are very noisy, and when using gasoline-powered units, the CO exhaust from the combustion engine is often blown into the building and can add to the dangerous atmosphere in the building. The use of PPV can be an effective method of ventilating a building, but should be done only at the direction of the officer in charge when the proper conditions exist.

Natural Ventilation:

This occurs by simply opening doors and windows on the windward side of a building as well as windows and doors on the leeward side of the building. The wind blowing fresh air in on one side of the building will cause bad air from inside to escape to the outside. This is another effective and easy way to ventilate when there are minor amounts of smoke and outside weather conditions are appropriate.

General:

Ventilation is a critical part of a safe and effective firefight. Effective ventilation allows the interior crews to be more efficient and work in less hazardous conditions. It also aids in the survivability of trapped victims. When proper ventilation takes place, things get better; visibility improves, the heat is reduced, the steam dissipates, fear and apprehension of firefighters go down, confidence goes up, movement throughout the building is quickened, and the overall efficiency of the operation is improved. When proper ventilation does not take place, everything slows down and remains dangerous. Often times the seat of the fire cannot be located and crews may be forced to exit the building and switch to a defensive mode. The task of accomplishing proper ventilation should be assigned early on at all building fires.

Ventilation needs are not limited only to structural fires. Ventilation may also be needed during hazardous materials incidents, carbon monoxide incidents, confined space incidents, or at any incident where undesirable air needs to be replaced with fresh desirable air.