
Section: 5.18 Positive Pressure Attack/Ventilation

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SCOPE

This guideline applies to all fire department personnel responsible for fire suppression operations.

PURPOSE

This guideline is intended to support fire department ventilation procedures for positive pressure attack (PPA) as a tactical option for initial fire attack in structures.

Note: This document is NOT intended to be an instructional material in PPA or a substitute for training. PPA is a safe, effective method when used properly, but can be extremely dangerous if used improperly. Like other fireground operations, PPA should never be attempted without adequate education and training from a competent source.

BACKGROUND INFORMATION

Fire naturally moves from areas of higher, or positive pressure, to areas of comparatively lower, or negative pressure. The largest area of negative pressure during a fire is outside of the structure. The positive pressure area inside and the negative pressure area outside are separated by the walls and roof of the structure. When a fire is in a free burning stage, firefighters can make an exhaust opening to the outside or improve an existing opening where the fire is already exhausting, then use a blower to add slightly to the already higher interior pressure. This is called Positive Pressure Attack (PPA). PPA can create a direct, safe path for fire travel to the outside and can be controlled to a large extent by the location and size of the exhaust, manipulating interior or exterior openings, or simply turning off the blower. The pressure created inside a structure by fire and the steam generated by water application is actually much higher than a positive pressure blower can create. PPA benefits to fire operations include:

- Heat and smoke are rapidly cleared from the fire structure early in the operation
- The chances for victim survival are increased
- Improved visibility aids firefighters in search and rescue
- Clean, cool air replaces the toxic interior atmosphere, so victims and firefighters face less exposure to heat and dangerous products of combustion
- Decreased damage to property from heat and products of combustion
- Crews that would normally be assigned to roof ventilation operations are available for search and rescue and fire control
- Attack lines can be rapidly advanced to the seat of the fire
- Fire spread is decreased due to cooling and rapid confinement
- Ventilation is controllable by using simple measures such as opening or closing doors or turning off the blower.

BASIC PPA PROCEDURES

In general, this section applies to single family dwellings, small commercial buildings and other, similarly-sized structures. Larger or more complex structures roughly follow these same procedures but may not follow them exactly. PPA can be broken down into four steps, with 1 and 2 happening at generally the same time.

1. Identify the ventilation opening and position the blower.

- **Crew member assigned.** A crew member must be assigned to take the blower from the engine to the fire building as they initially leave the apparatus.
- **Blower to entrance.** The blower should be positioned at the entrance that crews will be using to enter for fire attack, called the ventilation point or ventilation opening.
- **Distance from door.** For maximum effectiveness, a blower should be positioned 6 to 10 feet away from

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the ventilation opening, but will still be effective if closer or farther away.

- **When to direct airstream inside.** The blower should be started as soon as possible, the airstream should not be directed into the ventilation opening until the attack crew is ready to enter and the firefighter assigned to create the exhaust opening and survey the building gives the ok (*See Step 3. below*).

2. Survey the building exterior and create or improve an exhaust opening

- **Crew member assigned.** A crew member must be assigned to immediately survey the exterior of the fire building and make or improve an exhaust opening.
- **Victims at window.** PPA is not an option as long as victims are awaiting rescue in windows.
- **Make exhaust opening.** An exhaust should be made or improved at a location near the fire or, in the judgment of the firefighter, a location thought to be near the fire. This is called the exhaust point or exhaust opening. This opening should be substantial enough to exhaust the products of combustion. Generally this will be through opening 2-3 windows.
 - **Factors for determining exhaust opening location:**
 - *It is best to locate the exhaust opening as close to the fire as possible.*
 - *When there is already an obvious exhaust opening where fire and smoke are showing, use it and increase the size if fire and smoke are exiting the building under pressure.*
 - *When there is no obvious exhaust opening in the involved portion of the building a firefighter should make one according to best judgment and experience. When creating this exhaust, it is not necessary to break out an entire window if results are not positive. A thermal imaging camera can help determine the best location for the exhaust opening in circumstances such as this.*
 - *If there is no substantial exhaust from the first attempt, move to a window that is in the same area but a different room and attempt to create another exhaust opening.*
 - *If there is still not substantial exhaust and no other reasonable options, open lower floor exhaust openings to determine if the fire is below. A fire in a basement may require opening several windows to create enough exhaust.*
 - *If there are no results with the lower floor exhaust, consider the possibility of fire above that floor level and make exhaust openings in the most appropriate area.*
 - *If an exhaust opening is made in an area that is not actively involved in fire, fire will not readily burn into the uninvolved area due to the rapid decrease in temperature.*
 - *For a fire in an attic, crews must open the space from below and apply indirect fire attack to the attic space as crews move into the building*
- **Exhaust opening size.** The size of the exhaust opening is critical to the successful operation of PPA, and
 - should match the energy being created by the fire and the fire loading in the structure. A small room-and contents fire may require only two windows to be utilized as exhaust openings. Large commercial buildings with extensive involvement will require extensive exhaust openings.
- **Stand clear.** When making an exhaust opening, always stand to the side.
- **Exposures at exhaust opening.** Fire and products of combustion will forcibly vent from the exhaust opening when pressurization starts. *Always keep firefighters and the public away from exhaust openings.* The crew member making an exhaust opening must consider the proximity of nearby buildings and other exposures when deciding where to create an exhaust opening, and take measures to protect them when necessary.
- **Windows better than doors.** Windows are better exhaust openings than doors as they tend to keep heat and products of combustion higher, providing more survivable conditions for victims who may be at floor level. Exhausting through a door will tend to extend heat and products of combustion to floor level.
- **General considerations.** In general, exhaust openings should be ample sized and be created ahead of or substantially to the side of the likely path of advancing fire crews with more exhaust openings being created on the main fire floor than other involved floors.

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3. Begin pressurization and fire attack

- **Direct airstream inside.** After the building exterior has been checked, the exhaust opening ensured and the attack crew is in position with a charged hose line, the airstream from the blower can be directed inside the ventilation opening.
- **Enter after pressurization has started.** Crews must not enter until the blower has pressurized the structure for a short time, usually about 30 seconds, or until conditions improve and the interior environment starts to clear. The blower must always be “at the backs” of the initial attack crew.
- **Ventilation opening as indicator.** The upper area of the ventilation opening can be utilized as an indicator of the effectiveness of pressurization and interior fire activity. Heavy smoke or fire exhausting from the top of the opening above the pressure cone could be an indication that the exhaust openings are inadequate and may result in dangerous fire behavior if allowed to continue.
- **Remain aware.** Command and everyone involved in the fire operation must remain aware of fire behavior and smoke movement.
- **Overhaul aggressively!** Aggressive overhaul must begin as soon as possible! As early as possible in a fire, open up spaces in walls, ceilings and other areas that have been impinged on by the fire or are otherwise suspect. Open Early and Open Often!
- **Fire above or below.** Be particularly alert to the possibility of fire in the ceiling above or the floor below. When advancing into an area that has the possibility of fire above or below, open up frequent inspection holes.

4. Make sure the fire is out

- **Again, overhaul aggressively!** As early as possible in a fire, open up spaces in walls, ceilings and other areas that have been impinged on by the fire. Open Early and Open Often! This cannot be stressed too often.
- **Turn off the blower.** Turn off the blower for 10 to 15 minutes then thoroughly reexamine all involved areas for hidden fire.
- **Fire watch.** Post a fire watch, if necessary.

5. General Guidelines for Some Specific Fire Situations

These guidelines will not apply to all situations or conditions, and good judgment must always play a part in any decision. Search and rescue and firefighter safety are always top priorities.

Blower configurations

- Where additional blowers are required, placing two or more in “series” for narrower ventilation points, “parallel” for wider ventilation points. If space allows, using blowers in a V-pattern increases the exhaust volume by as much as 30 percent.

Attic fires

- Start PPA in the attack entrance to pressurize the area below the fire. An exhaust opening is not necessary if
- the space below the attic is clear of smoke.
- Initial attack should be through adequately sized openings made in the ceiling below the attic that are large enough to observe the attic environment. Apply water through the holes as necessary.
- Move from one room to another on the floor below making inspection/fire attack holes.

Chimney fires

- Pressurize the interior of the structure and restrict exhaust openings to ensure that fire, products of combustion and burning material will be confined to the fireplace.
- Extinguish fire with small amount of dry chemical, CO₂ or water.
- Check for extension.

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Fire in an attached garage

- Pressurize attack entrance of dwelling.
- Advance a hose line into the garage through the dwelling using the interior doorway between the dwelling and garage.

Vehicle/trash fires

- Set up blower upwind of fire.
- Crews attack fire with blower at their backs.

Multi-story/high-rise

- Generally are complex and require close coordination with all division and group supervisors. A Ventilation
- Group should be established in the command structure.
- Must coordinate fireground ventilation with any building ventilation systems.
- Pressurize stairwells at ground level. With proper use of exhaust openings and adequate pressurization, they will conduct air flow to floors where necessary.
- Multiple blowers may be required to pressurize the building. Additional blowers may be needed on landings at various levels in the stairwell. A blower will be needed at the entry to the fire floor.
- For exhaust openings, a window or other opening in the fire area is a good choice. A stairwell on the opposite side of the fire area may also be appropriate to exhaust through a door at roof level.
- Consider exhaust opening locations carefully, as it will become a conduit for the energy and products of the fire. Floors with the most extensive fire involvement will require more exhaust than other floors.
- Be cautious of the effects wind may have on the fire if windows fail during the fire attack.

Exposure protection

- When a structure or separate area within an involved structure is not involved in fire but at risk.
- First priority should be for PPA on involved building/area, then to highest risk exposures.
- Set up blowers the same as for any positive pressure operation but do not create exhaust openings.
- Monitor interior and exterior conditions. Open up high risk interior walls or ceilings. Hoselines may be required on the exterior, and should be readily available for the interior.
- Very effective with common attics, such as in strip malls and apartment complexes, or where separating walls may have been breached, such as with electrical or plumbing installation.
- Monitor CO levels and protect personnel.

Large buildings

- May require multiple blowers, perhaps at more than one location in the structure.
- For larger buildings the placement of interior blowers is recommended to enhance pressurization. As the environment starts to worsen inside large buildings add additional blowers to the interior supporting the exhaust path that has already been established.
- May be complex and require close coordination with all division and group supervisors. A Ventilation Group should be established in the command structure.
- Mounting a fire attack takes more time and, therefore, there is more time to plan ventilation and complete the exhaust openings. In these situations the exhaust opening may best be assigned to later arriving truck or engine.
- Monitor CO levels and protect personnel.

Basement fires

- Blower placement may call for creativity.
- Making an exhaust opening close to the fire may not be possible, but any opening is better than none.
- Basement windows are often small, so several may need to be opened up for an adequate exhaust.
- If the ventilation opening must also be the exhaust opening, PPA will likely not be a good option.

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Safety Precautions

- Department members must be properly trained in PPA with strong command and control of the fire being of prime importance.
- All first arriving apparatus must be equipped with blowers.
- Command should only order PPA before firefighters enter the structure. Pressurization should never be initiated after fire personnel are inside a structure.
- The area near an exhaust opening can be hazardous. Do not begin PPA when a victim is awaiting rescue at a potential exhaust opening. Do not use the exhaust opening as an entrance. Keep fire crews and the public away from the exhaust opening. If necessary, take steps to protect exposures in the proximity of the exhaust opening.
- Make sure the fire is out. Open up all areas that could harbor hidden fire. Thoroughly reexamine the area after the blower has been off for 10 to 15 minutes.
- Never use a blower where backdraft conditions may be present, or in the presence of combustible dust or flammable vapors.
- Do not attempt PPA without securing an exhaust opening. If fire or heavy smoke are exhausting above the blower at the ventilation point, do not enter until enough forward exhaust can be obtained.

6. Staffing

South Metro Fire assigns the following tasks to first-due truck positions, based on typically available staffing:

 3/2 Staffing Assignments**Engine – 3 Personnel****Officer**

- 360 Size-Up
- Make Exhaust Opening

Driver

- Place Fan – Idle Start
- Charge Lines

Nozzle

- Stretch Attack Like

Ladder – 2 Personnel**Officer**

- Search & Rescue

Driver

- Search & Rescue

 2/2 Staffing Assignments**Engine – 3 Personnel****Officer**

- 360 Size-Up
- Make Exhaust Opening

Driver

- Place Fan – Idle Start
- Charge Lines

Ladder – 2 Personnel**Officer**

- Stretch Attack Line
- Entry w/ Engine Officer

Driver

- Assist Engine Driver
 - Place Fan – Idle Start
- Stretch Backup Line