



Firefighter Series

COURSE GUIDE

Positive Pressure Ventilation

Fourth Quarter 2009

INTRODUCTION

Positive Pressure Ventilation (PPV) is the tactical application of air flow from mechanical devices to ventilate heat and fire gases from a burning structure. This class will look at how to use PPV as a tool to assist fire suppression activities, show when PPV should be used, discuss contraindications for using PPV, outline safety considerations when using PPV, demonstrate how to set up PPV, and show the interrelated actions of command, the fan operator, interior crews, and ventilation crews.

LEARNING OBJECTIVES

Cognitive

1. Explain the signs and conditions to use positive pressure ventilation in a building.
2. Describe how to use PPV to ventilate a building.
3. Discuss the benefits of ventilating a building.

Psychomotor

1. Demonstrate how to use PPV to ventilate a building.

NFPA STANDARD

None

PREPARE

1. Watch the program Positive Pressure Ventilation.
2. Review planning tips, gather equipment, materials, and supplies listed.
3. Review Key Points.
4. Review training evolutions and adapt them to your department policies and procedures.

KEY POINTS

Note: Fire ground tactics and incident operations are not standardized throughout the United States, for this reason you may see operations and techniques different than those of your department. Always follow your department's standard operating procedures and guidelines. Consider using the examples presented in the program for discussion or as an additional learning opportunity.

- Objective of PPV is to reduce heat and smoke conditions and improve visibility.
- Ventilation exit point must be controlled.
- Know building construction types.
- Lightweight construction buildings may be unsafe to enter.
- Building must be safe to enter.
- Know the exact location and extent of the fire.
- Know the location of interior firefighters and any victims.
- PPV tactics require close coordination and good communication between command, the fan operator, interior crews, and exit point ventilation crew.
- Consider natural ventilation.
- Exit point placement relative to prevailing winds, interior crews and victims, and outside exposures.
- Location and set-up of the fan.
- Keep fan staffed whenever it is running.
- Be prepared to shut fan off if PPV goals are not being realized or if PPV is making the situation worse.
- Full protective gear essential for fire, heat, and carbon monoxide protection.
- Pressurizing high-rise stairwells to clear for firefighter and victim use.

LESSON OUTLINE

NOTES

- I. Positive Pressure Ventilation (PPV)
 - A. Tactical application of air from a mechanical device.
 - B. Used to remove heat and smoke from inside a burning structure.
 - C. Objective is to improve visibility.
 - D. Vents combustion products through a controlled exit point.
- II. Ventilation is a group function
 - A. Likely performed by truck companies in urban areas.
 - B. May be done by engine or rescue companies outside urban areas.
 - C. Ventilation performed by a group regardless of type of responding company.
 - D. Usually supervised by a company officer.
 - E. Company officer reports to Operations section or IC.
- III. When to use PPV
 - A. Know the construction type.
 - B. Know exact location and extent of fire.
 - C. Is the fire burning contents, or structural components, too?
 - D. Know exactly where any trapped victims are.
 - E. Do not push the fire toward victims.
- IV. Pros and cons of using PPV
 - A. Can be very effective when used properly.
 - B. Can cause greater damage and harm to people when used inappropriately.
- V. PPV tactics require coordination
 - A. Command and all companies must be operating from the same plan.
- VI. Controlling the fire
 - A. Have enough available personnel.
 - B. Have hose lines of the proper size in place to put the proper amount of water on the fire.
 - C. Do not vent the fire out onto an exposure.
 - D. Do not vent the fire over victims.
 - E. Do not vent the fire against the prevailing wind.
- VII. Ensure building is structurally safe
 - A. Has the fire impinged on structural elements?
 - B. Consider natural ventilation if structure is unsafe.
- VIII. Gas-powered fans
 - A. Have more power than electric fans.
 - B. Can flow air at up to 14,000 cfm.
 - C. Engine produces carbon-monoxide, a hazard to unprotected firefighters.
- IX. Fire spread concerns
 - A. Premature application of PPV can spread fire throughout the structure.
 - B. Do not push fire toward trapped victims or working firefighters.

LESSON OUTLINE (*continued*)**NOTES**

- X. Create an exit point
 - A. Locate to direct the heat, smoke and fire where you want it to go.
 - B. Place hose lines to protect the exit opening, adjoining rooms, corridors and stairwells.
- XI. Setting the fan properly
 - A. Elevate the fan 10-15 degrees above horizontal.
 - B. Place from 10 to 15 feet outside the doorway where you want the air to enter.
 - C. Close other doorways adjacent to the fire area to prevent fire and smoke spread.
- XII. Starting the fan
 - A. Create a cone of air that passes freely through the doorway and covers all edges.
 - B. Attack crews will expect an increase in fire intensity for 1-2 minutes.
 - C. As heat and smoke diminish, attack crews can advance hose lines and extinguish the fire.
- XIII. Safety concerns
 - A. Directing outside hose lines in through the exit can direct flames and heat back onto interior crews.
 - B. PPV can cause fire to intensify and spread.
 - C. Keep a firefighter at the fan at all times and be able to communicate orders to shut the fan off.
 - D. All firefighters must wear approved protective equipment, including SCBA.
 - E. All hose lines must be in place and charged prior to initiating PPV.
 - F. Use thermal imaging camera to track fire spread.
 - G. Check interior atmosphere safety with a carbon monoxide monitor after fan is shut down.
- XIV. PPV in high-rise stairwells
 - A. Pressurize stairwell to keep it clear of smoke.
 - B. Firefighters can use cleared stairwell to expedite entering the building.
 - C. Firefighters can work from clear areas.
 - D. Victims can use cleared stairwells to expedite leaving the building.

TRAINING EVOLUTIONS

Overview — Tactical positive pressure ventilation can speed the extinguishment of the fire, limit its spread to adjoining areas of the burning building, reduce the working temperature inside the building, and improve visibility. These are all positive outcomes that enhance survivability for victims. They are also all factors in improving firefighter safety working in and around the burning building. The training evolutions are designed to practice reading a building to determine construction type, location and extent of the fire, potential for and locations of victims. They are also designed to offer firefighters hands-on practice of skills including deploying a fan, advancing hose lines in front of the fan, creating and controlling an exit point, and performing these three tasks in a fully coordinated fashion.

WEB LIBRARY

For a direct link to these sites, click on the web address below or go to www.hsi.com/24-7fire/

Firehouse.com

Extinguishing Chimney Fires with Positive Pressure Ventilation

[http://cms.firehouse.com/web/online/Firefighting-Strategy-and-Tactics/Extinguishing-Chimney-Fires-With-Positive-Pressure-Ventiation/14\\$48834](http://cms.firehouse.com/web/online/Firefighting-Strategy-and-Tactics/Extinguishing-Chimney-Fires-With-Positive-Pressure-Ventiation/14$48834)

Firetactics.com

Tactical Ventilation — Venting Actions by On-Scene Firefighters, Used to Gain Tactical Advantage During Interior Structural Firefighting Operations; Grimwood P.

<http://www.firetactics.com/TacticalVentilation.pdf>

NIST.gov (National Institute of Standards and Technology)

Effect of Positive Pressure Ventilation on a Room Fire.

Kerber S, Walton W; 2005.

<http://www.fire.nist.gov/bfrlpubs/fire05/PDF/f05018.pdf>

Phoenix.gov

Phoenix Regional Standard Operating Procedures.

Positive Pressure Ventilation

<http://www.phoenix.gov/fire/20212d.pdf>

Springerlink.com

Advances in Positive Pressure Ventilation: Live Fire Tests and Laboratory Simulation. Ziesler P, Gunnerson F, Williams K; 1994 Fire Technology; 30(2).

<http://www.springerlink.com/content/k341r25101577t52/>

CDC.gov (Centers for Disease Control and Prevention)

Preventing Injury and Deaths of Fire Fighters Due to Truss System Failures; National Institute of Occupational Safety and Health; 2005.

<http://www.cdc.gov/niosh/docs/2005-132/pdfs/2005-132.pdf>



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MATERIALS NEEDED

- Full turnouts with SCBAs for all Firefighters and Vent Officer.
- Ventilation fan
- Smoke machine (if available)
- Hose lines to deploy
- Hydration for working crews

PLANNING TIPS

Try to keep the engine being used as close to in-service condition as possible by using spare hose and other equipment if you can.

Use full, realistic radio traffic and commands on an off-channel frequency to enhance the scope and realism of the scenario.

Consider having medical personnel participate by setting up and practicing a rehab operation.

If time allows, go through more than one evolution with firefighters switching roles to gain more experience.

Between evolutions, invite feedback from participants. Incorporate lessons learned and questions raised into the next evolution.

The training ground is the place to try new methods so long as firefighter safety is never compromised.

FACILITATOR NOTES

The best training is that which duplicates the skills needed and actions to be taken as if they were real calls. Any shortcuts taken on equipment, protective equipment worn and used, procedures followed, or firefighter accountability systems will diminish the value of the training and can lead to similar performance on a real fire ground. Shortcuts taken in training can result in serious firefighter safety issues and equipment misuse on the next real call.

TRAINING EVOLUTIONS

If you have access to a burn training facility or a practice structure of some kind, use it to run through these training scenarios. If such facilities are not available to you, you can still gain valuable training by setting up these scenarios in your station.

These scenarios are designed for four persons and focus on individual elements of PPV. Consider expanding the scenarios to multi-company operations to train on complete PPV evolutions incorporating all tasks. Have companies switch tasks on succeeding evolutions.

Training Evolution #1 — *Moderate smoke is showing from a shoe store in a strip mall. The sprinkler system controlled the fire, but smoke has spread throughout the store.*

Create the smoky shoe store in an apparatus bay with at least two man doors, external exits, not on the same wall. Remove apparatus, close all doors, and set up smoke machine inside using non-toxic smoke. Arriving company must determine the location of the fire and type of construction, choose which of the exit doors will be the exit point, and deploy as the exit ventilation crew.

Training Evolution #2 — *Moderate smoke is showing from a shoe store in a strip mall. The sprinkler system controlled the fire, but smoke has spread throughout the store.*

Create the smoky shoe store in an apparatus bay with at least two man doors, external exits, not on the same wall. Remove apparatus, close all doors, and set up smoke machine inside using non-toxic smoke. Arriving company must determine the location of the fire and type of construction, choose which of the exit doors to set up the fan, then deploy and perform PPV on the building.

Continued

Training Evolution #3 — *Heavy smoke is seen inside kitchen area of the station's crew quarters. Fire appears to be limited to stove and countertops.*

Arriving company must determine the location of the fire and type of construction, choose the interior crew entry point, and PPV set-up placement. Deploy interior crew and PPV fan. While deployed, signal fan shut-down and emergency egress from the building.

Training Evolution #4 — *Heavy smoke is seen inside one bedroom of the station's crew quarters. Fire appears to be limited to furniture.*

Arriving company must determine the location and type of construction, choose the exit point, interior crew entry point, and PPV set-up placement. Deploy fan and exit point ventilation crews.

Training Evolution #5 — *Heavy smoke is seen inside one bedroom of the station's crew quarters. Fire appears to be limited to furniture.*

Arriving company must determine the location and type of construction, choose the exit point, attack crew entry point, and PPV set-up placement. Deploy PPV fan and interior crew. When smoke clears, interior crew finds and rescues victim.