ISFSI

INSTRUCT-O-GRAM

THE HANDS-ON TRAINING GUIDE FOR THE FIRE INSTRUCTOR

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VENTILATION

TIME REQUIRED

Three hours

INSTRUCTIONAL AIDS

Acquired structure or ventilation props
Various hand and power tools
Ventilation equipment
Smoke generation equipment

MOTIVATION

Effective use of ventilation is crucial to the outcome of firefighting objectives.

OBJECTIVES

1. The student will be able to demonstrate a basic understanding of the methods of ventilation and ventilation techniques by applying those ventilation techniques in a practical setting.
2. Explain the following:
   a. Natural and mechanical ventilation.
   b. Positive and negative pressure ventilation.
   c. Hydraulic ventilation.
3. Describe ventilation techniques in various types of structures.
4. Demonstrate the proper procedure for placing fans for positive and negative pressure ventilation in a door or window (NFPA 1001 (1997) 3-3.10).
5. Demonstrate the proper use of various hand and power tools to force entry through a roof for ventilation (NFPA 1001 (1997) 3-3.11).

OVERVIEW

Ventilation

Explain natural and forced ventilation
Describe ventilation techniques in various structures
Demonstrate forced ventilation techniques
Demonstrate roof ventilation

I. Explain Natural And Forced Ventilation
   A. Windows
      1. When time permits, windows should be opened.
         a. Double hung windows should be opened two-thirds down from the top and one-third up from the bottom.
         b. Open other types of windows as much as possible.

c. Storm windows must also be opened or removed.

d. Shades, blinds, drapes, curtains, and other window coverings must be moved away or removed.

e. When wind is a factor, windows on leeward side should be opened first.

2. Window and Roof Ventilation

a. When roof or roof features must be opened for venting, windows on the top floor should be opened.

b. If windows on several floors must be opened, begin on top and work down.

c. Opening windows from below first may cause fire and smoke spread.

B. Natural Roof Openings

1. In multi-story buildings, vertical shafts include stairways, elevators, dumb-waiters, electric wiring, heating ducts, and plumbing and sewer pipes.

2. Shafts extend the full height of the building.

3. Convected heat, smoke, and gases will rise within and around shafts.

4. If shafts are not vented at the top, fire will begin to travel horizontally.

5. Pressure will force heat, smoke, and gases throughout the upper part of the building.

6. Shafts are capped at roof with various closures. (Make sure of the area being vented when cap is removed).

C. Cutting Through Roofs

1. At times, the only way to properly ventilate is to cut a hole in the roof.

a. Roofs made of multiple boards can be cut with an axe.

b. Roofs made of plywood should be cut with a power saw.

c. Care should be taken not to cut joists or other structural members.

2. A single large hole is more effective than several small holes.

a. One 4' x 8' hole has twice the area of four 2' x 2' holes.

b. All roof boards should be cut through before they are pulled up.

c. If possible, personnel should keep their back to the wind when pulling boards.

d. When all boards are ripped are up, make an opening in the ceiling below.

3. Special care should be taken when fire is immediately below the roof.

a. Open the roof as close as possible to the seat of the fire.

b. If not, fire will be drawn across the top of the building to the opening.

c. Hot spots may develop on the roof.

d. If the roof is flat, the opening should be made at the hot spot.

e. On gabled roofs, openings should extend from the hot spot to the peak.

f. Drafts can be increased by making an additional opening just above the eave line on the side opposite the original opening.

g. Care should be taken so that the opening does not increase fire spread.

D. Forced Ventilation

1. Smoke Ejectors

a. Should not be used as a substitute for natural venting techniques.

1) Fans should not be used in partially or completely confined spaces in which there is fire.

2) May be used in confined areas after fire has been knocked down.

b. Fan Placement

1) Fans most effective when placed where they tend to increase natural airflow.

2) When fans are positioned in windows or doorways, all shades, drapes, blinds, curtains, and screens should be removed.

3) If possible, the open area around the fan should be closed to increase fan efficiency by directing air through the opening and preventing smoke from re-entering.

4) Be careful not to exhaust smoke into congested areas or into heating and cooling intakes.

c. Fans in Tandem

1) Can be especially effective when used in pairs.

2) Place one fan near an outside opening blowing smoke out and

the other inside the room to blow smoke to the first fan.

3) Fans can be used to exhaust smoke and draw in fresh air at the same time.

4) Exhaust fans should be mounted high in the vent opening.

5) Intake fans should be lower.

2. Positive Pressure Fans

a. Introduction

1) Fresh air is introduced to increase pressure.

2) Selective process of opening and closing doors and windows - effective on all structures when doors and windows are maintained and operable.

3) Initiated outside structure.

4) Has potential of moving fire and fire gases if used improperly.

5) Generally speaking, initiated between fire fighters and fire or between fire and trapped victims.

6) Can maintain primary and secondary egress routes.

7) Quicker than negative pressure ventilation.

8) Works well in large areas.

b. Fan Placement

1) Place fan far enough away from the door to create a cone of air sufficient to fill the opening.

2) Stacking fans greatly increases volume.

3) For oversized doors, place fans side by side or in tandem.

4) For single fan, place approximately 6' to 10' from doorway (Distances may vary depending on fan size).

5) For multiple fans, place approximately 3' to 5' from doorway. (Distances may vary depending on fan size).

3. Fog Streams

a. Can be used to start venting immediately after fire has been knocked down.

b. To be most effective, stream should be positioned so that fog pattern covers most of the window opening.

c. Hold the nozzle a few feet (2-3 feet) inside the window.

d. Observe smoke movement to determine the proper position of nozzle.

e. Fog streams should not be used for venting if they damage:

1) Items removed for protection.

2) Outside of fire building or enter adjourning buildings.

3) Inside of room from which directed.

f. Should be short-term operation.

II. Describe Ventilation Techniques In Various Structures

A. One-Story Dwellings

1. Open or remove windows close to fire.

2. First windows to be opened are those of which fire and/or smoke are pushing out or through which fire can be seen or heard.

3. Other windows should be opened to complete ventilation.

4. Attic or cockloft should be checked for fire spread, especially area over fire.

B. Two-Story Dwellings

1. For fires on the first floor, first floor windows closest to the fire should be opened immediately.

2. Second floor should be vented as soon as possible.

3. For fire on second floor, the second floor must be vented first.

4. Start by venting outside of premise and move inside.

5. Check attic or cockloft for fire. Especially important where units are side by side.

C. Attic Fires

1. Attack fire from inside structure rather than through windows.

2. Attics can be ventilated using windows or louvers.

3. If necessary, open roof near peak or hot spots.

D. Basement Fires

1. Fires in small dwellings should be vented through all available basement openings.
2. Venting should be coordinated with attack lines.
3. Attack lines should be taken through both outside basement entrance and first floor basement entrance. Caution must be used to avoid opposing streams.
4. If attack is through only one entrance, other available openings can be used for venting.
5. Venting the first floor can assist in positioning and advancing lines.

E. Multiple-Use Residential and Business Buildings

1. Roof Operations
   a. Should not use interior stairs for access.
   b. Use interior stairs of building when it abuts fire building.
   c. Use fire escape of fire building if it has roof access.
   d. If no other way, use ground ladders or aerial unit.
   e. Ladder should remain in place until crew leaves roof.
   f. If visibility is poor, crew should probe roof with tools before stepping onto it.
   g. Crews should immediately look for another way off roof in case of emergency.
   h. Secondary ladder should be placed opposite the first for emergency egress.
2. Venting
   a. Roof venting should be cut with available natural openings.
   b. Roof features showing smoke should be opened first.
   c. Skylights, scuttles, and penthouses should then be quickly opened.
   d. Tops of vertical shafts should be checked and opened if needed.
   e. Once roof has been vented, the top floor should be opened from exterior or interior.
   f. Should not attempt to enter top floor from roof if heavily charged with smoke. Open windows from aerial ladder or platform.
   g. Ground ladders can be used to knock out top floor windows on shorter buildings. (ONLY AS A LAST RESORT).
   h. Floor just above fire floor must be thoroughly vented.
   i. Fire floor must be vented to allow for the advancement of hoselines and search for victims.
3. Ground-Floor Stores
   a. Vent roof, top floor, and floor above fire.
   b. Vent store thoroughly.
   c. Open utility shafts to deter fire spread.
4. Adjoining Buildings
   a. Adjoining buildings should be vented and cocklofts checked for fire extension.
   b. Vent through skylights, scuttles, and penthouse to keep damage to a minimum.
   c. If the cockloft is not vented when skylights or scuttles are opened, the boxed area below will have to be opened.
   d. Exposure fire should be completely vented with a roof opening over the hot spot.

F. Shopping Centers, Row Stores, and Other One-Story Buildings

1. Roof Operations
   a. Assume no fire walls between stores or building sections.
   b. Roof should be opened for venting first.
   c. Use natural roof feature for first opening only if close enough to hot spot.
   d. If natural roof feature is not close enough cut an opening over or near the hot spot.
   e. After making one opening over the main body of fire, natural openings can be used.
   f. Roof venting operations must be effective because these buildings are practically windowless.

g. Be aware of roof areas which might be particularly hazardous (i.e. lightweight truss construction).

h. Steel roof girders and joists are exposed from below with no protective layer between steel and heat of fire.

i. Avoid areas if roof is spongy or sagging.

2. Attached Occupancies

a. Once the fire building roof is properly opened, roofs of attached buildings should be opened through natural roof features.

1) Determine whether fire has spread.

2) Allow accumulated gases to escape.

b. If fire is found in attached exposures, the roof should be opened over the fire.

3. Ground-Level Ventilation

a. When necessary, store can be ventilated through front display windows and through rear windows and doors.

b. Window lights may be easier to remove.

G. Basement Fires in Large Structures

1. Basement Venting

a. Any opening into basement can be used for venting.

1) If possible, ventilation openings should be away from those being used for fire attack.

2) If single entrance, ventilate though basement windows.

3) With single entrance, if fire is extinguished quickly, venting first floor may suffice to clear basement.

4) First floor should be cut open to basement just inside the front window if first floor venting does not suffice.

5) Open the front window on the first floor to remove or draw smoke and gases from basement.

6) For basement windows below ground level, knock out glass and remove grates if needed.

b. Storefront Walls

1) If there are no basement windows or doors in the front of the fire building, open the low wall below the display window to vent the basement.

2) Knock out display window before opening the low wall.

3) Procedure used depends on material involved.

4) Basement ceiling may need to be removed.

5) May need to open display window floor to ventilate basements.

6) If store has two display windows, both display window walls or floors should be opened.

c. Other Openings - Any opening that will help ventilate basement should be used to permit fire attack and lessen chance of fire spread.

2. First-Floor Venting

a. Vent through windows to remove combustion products.

b. Venting increases effectiveness of search and reduces chance of fire spread.

3. Roof Venting

a. Shafts running through building must be opened at roof.

b. Helps vent basement and prevents smoke accumulation and ignition of upper part of building.

H. Fire Resistant Structures - Cannot be vented in same way as more standard structures.

1. Window Venting

a. Best way to ventilate.

b. Prop doors open and open as many windows as possible on both sides of corridor.

c. If necessary, smoke ejectors can aid in ventilation.

d. Vent first floor first.

e. As soon thereafter as possible, vent the floor above fire and search for victims.

f. Hose lines should be advanced to the floor above the fire to keep fire from extending vertically.

2. Stairway Venting
   a. If the building is unoccupied or completely evacuated, doors from corridors to stairways can be opened.
   b. Stairway shafts will draw smoke from corridors and provide vertical venting.
   c. Remove heat and smoke as quickly as possible to relieve physical strain on personnel.

III. Demonstrate Forced Ventilation Techniques

A. Full protective clothing including eye protection is required for this section.

NOTE: Review the skills and techniques covered in the Fire Fighter I program. This session should be an opportunity to practice previously learned skills rather than a session where new skills are learned.

B. It may be appropriate to review the handling, use, and operation of the tools to be used prior to any student demonstrations.

C. Demonstrate the proper procedure for placing fans for positive and negative pressure ventilation in a door or window.

IV. Demonstrate Roof Ventilation Techniques

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B. It may be appropriate to review the handling, use, and operation of the tools to be used prior to any student demonstrations.

C. Demonstrate the proper use of various hand and power tools to force entry through various roof materials for ventilation.

REVIEW

Ventilation

Explain natural and forced ventilation.
Describe ventilation techniques in various structures.
Demonstrate forced ventilation techniques.
Demonstrate roof ventilation.

REFERENCES

Truck Company Fireground Operations, Second Edition, Chapters 4 and 5
Essentials of Firefighting, Fourth Edition, IFSTA, Chapter 10

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