

# SECTION 7- THE FIRE SERVICE

## UNIT 6 - FIRE DEPARTMENT OPERATIONS

### UNIT GOAL

To introduce the student to the basic operations that occur at a typical fire scene. This will include engine and truck functions.

### UNIT OBJECTIVES

The student by the end of the semester shall:

- Define the following terms
  - Forcible entry
  - Ventilation
  - Direct fire attack
  - Indirect fire attack
- List the three [3] purposes of attack lines
- List two [2] types of search
- List four [4] types of ventilation
- List three [3] types of nozzles used at structure fires
- Explain the importance of coordination of functions at a fire incident

### KEY TERMS

Forcible Entry	Supply Line
Ventilation	Salvage
Primary Search	Ground Ladders
Secondary Search	Direct Attack
Attack Line	Indirect Attack

### INTRODUCTION

The fireground can look like mass confusion to the uninformed, but in reality the actions taking place are a concise and coordinated attack on the fire. There are different types of functions that take place on the fireground that make this coordinated attack work.

There different types of emergencies that the fire department respond to that are fire related.

- Structure fires
- Vehicle Fires
- Flammable Liquid & Gas fires
- Wildland fires
- Trash & Rubbish fires

Each of these incidents has its own particular hazard that must be dealt with. For all of these fires there are three things that must be accomplished - ***Locate the fire, Confine the fire, Extinguish the fire.***

In this unit we will look at some of the functions and the operations that occur at structure fires and also look at basic operations at other types of fires.

## **STRUCTURE FIRES**

At all structure fires, whether it is a single story house or a forty story high-rise, certain functions must be carried out. These functions are the following.

- Forcible Entry
- Search & Rescue
- Ventilation
- Ladders
- Salvage
- Water supply
- Hoseline Operations

Each of these functions by itself is important. But there must also be coordination between them. Typically these functions are divided up between truck companies and engine companies.

### **TRUCK FUNCTIONS**

Forcible Entry  
Ventilation  
Ladders  
Salvage  
Search & Rescue

### **ENGINE FUNCTIONS**

Water Supply  
Hoseline Operations

## **TRUCK FUNCTIONS**

Truck company functions are designed to support the engine company functions. While they may not always be performed by a “dedicated” truck company, they still must be performed. Without these functions there is no way that an engine company could effectively and safely control and extinguish a fire.

### **Forcible Entry [See Figure 1]**

The most effective way to extinguish a fire is to get to its source, this requires entering the structure. Sometimes this can be very simple and other times very complex. Typically forcible includes the following.

- Check the door to see if it is unlocked or locked
- Use manual tools [axe, pry bar, halligan tool] to force doors
- Dismantling the locking mechanism [through the lock method]
- Use of power tool [saws, torches, hydraulic spreaders]
- Entry may be made through windows and/or walls
- A fire hose with a nozzle should be on hand any time forcible entry is going to be made to prevent the fire from intensifying once the opening has been made



**Figure 1** - Example of Forcing a Door

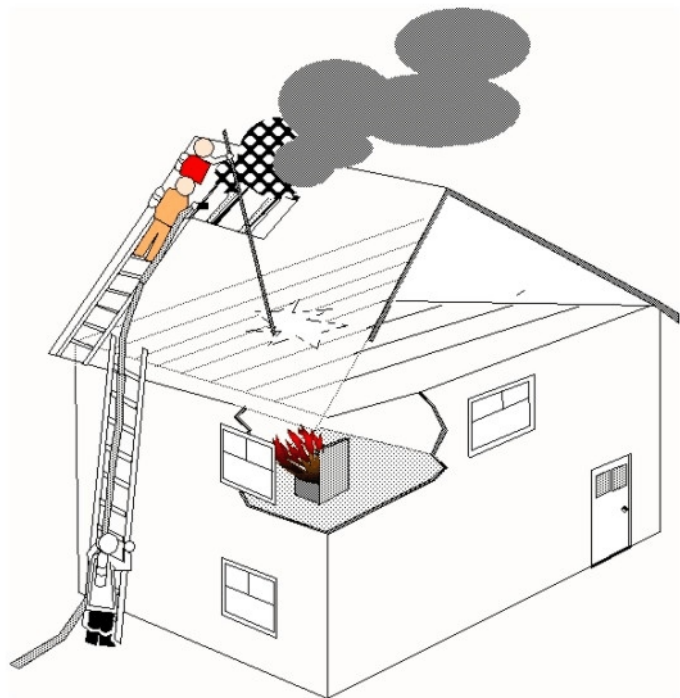
**Ventilation [See Figure 2]**

Ventilation is the systematic removal of heat, smoke and toxic gases from a structure and its replacement with cooler, fresher air. This function is critical to all other functions. If not done correctly it can cause rapid spread of the fire, limit entry of attack personnel, prevent search for victims and the location of the fire. Ventilation if done properly allow several things to happen.

- Confines the fire
- Removes smoke, heat, and toxic gases
- Improves visibility
- Protects firefighters and building occupants
- Reduces the potential for Backdraft

Ventilation functions include

- Vertical ventilation - Making an vent opening at the highest point above the fire, such as, making a hole in a roof, opening a skylight, or a bulkhead door.
- Horizontal ventilation - Making a vent opening above the fire or on the same level as the fire, such as, opening a window or a door.
- Natural ventilation - ventilation that relies on the ability of natural buoyancy of heated air to allow the heat, smoke and gases to escape the building
- Mechanical ventilation - ventilation that use fans and water sprays to force the heat, smoke, and gases from the structure
- Positive Pressure Ventilation - This is a method of mechanical ventilation using fans that move air into a room or structure in conjuncture with horizontal ventilation. This method allows for smoke and heated gases to be pushed out of the structure ahead of the advancing firefighters.



**Figure 2** - Example of Vertical Ventilation

Ventilation must be coordinated with hoseline operations. Ventilation should not take place until hoselines are charged with water and in place at the vent openings.

### Ladders [See Figure 3]

One of the most under used pieces of equipment in the fire service are ground ladders. If not used they can hinder access to the structure by attack personnel, limit escape options for personnel working within the structure, limit access to ventilation teams for vertical ventilation. Fire service ladders can be ground ladders [ 14' to 50' in length] or aerial ladders [55' to 110' in length]. Ladders allow firefighters to do the following:

- Access upper floors from the outside for hose line advancement
- Provide a secondary means of egress for occupants still trapped in the building
- Provide a means of access for ventilation teams to upper areas to perform ventilation functions
- Provide a secondary means of escape for firefighters who are working above the fire



**Figure 3 - Example of Ladder Operations**

### Salvage

Salvage is an important part of firefighting in that it helps to protect property from fire, smoke and water damage that can occur as result of a fire. This can be accomplished in several ways.

- Placing salvage covers over furniture and other valuables to protect them from water damage
- Removable of valuable to a safe place
- Channeling water out of a building to limit water damage and to prevent possible collapse due to the excessive weight of water

Some reasons for performing salvage are:

- Keeps insurance rates down
- Building remains occupied
- Occupants do not need to relocate
- Keeps repair costs down
- Saves occupants form unnecessary hardship
- Fire service viewed as professional
- Obligation to the community

Salvage when done properly can be a valuable public relations tool for the fire department by showing that the fire department is concerned about the occupants personal property.

### Search & Rescue [See Figures 4 & 5]

Of all of the functions performed on the fireground this is the one that deals directly with life safety - this means occupants as well as emergency service personnel. Search and rescue can entail helping a victim from the building to performing searches for unaccounted occupants and/or firefighters. Search as with any other function on the fireground is a team effort and should not be attempted by a single individual. Search can also include the search for the fire itself. primarily there are two types of searches performed at a fire, these are primary and secondary. The primary search is a quick search of the structure prior to the fire being under control. This can include searching for occupants and the location of the fire. The secondary search is a more deliberate search of the structure after the fire has

been brought under control. As with other functions search must be coordinated with other functions.

- Hoselines should be in place
- Ladders should be raised to upper floors as a secondary means of escape
- Ventilation of the structure should take place prior to search crews entering the structure to allow for more tolerable conditions in the structure.

#### Search Tips

- Plan the search
- Check behind doors and under windows immediately
- If the door opens easily then stops, there is a good chance there is a victim behind it.
- Use caution when searching with tools to avoid injuring victims
- Do not let a door lock behind the searcher. Chock it or leave a firefighter at the door.
- Confine a fire by closing a door, then continue with the search
- Work around walls, probing toward the center of the room.
- Use a tool as an advantage, it increases arm length.
- Vent during the search as long as it will not extend the fire.
- Listen for crying, moaning, or coughing
- Check all closets and cabinets
- Do not assume locked rooms are empty
- Look under beds
- Treat furniture as an extension of the wall, do not move it
- Check refrigerators, toy boxes, and dressers for children
- Look out a window if disoriented
- The primary way out is the way the entry was made
- Plan your own escape route.



**Figure 5 - Primary Search**



**Figure 4 - Secondary Search**

## ENGINE OR PUMPER FUNCTIONS

### Water supply

Firefighters get water from one of several sources, static supplies, such as, ponds, lakes, rivers, cisterns. Other sources are water tanks stored onboard the apparatus, such as, pumpers with tanks [250 gallons to 1,000 gallons] or water tenders (tankers) with supplies up to 3,500 gallons. And lastly municipal water systems.

The pumper can either be at the water source or at the fire. There can also be two pumpers, one at the source and one at the fire. Other combinations are as follows:

- When the pumper is at the fire it is called a straight lay or water to fire [See Figure 6]
- When the pumper is at the water source it is called a reverse lay or fire to water [See Figure 7]
- When two or pumpers are used between the water source and the fire it is called a relay
- When water is used from the tank on the apparatus is its called “using booster tank water”
- When water is used from a water tender [tanker] it is called a tanker shuttle



Figure 6 - Example of a Forward Lay



Figure 7 - Example of a Reverse lay

The water that is supplied to the fireground is used for the following

- Handlines with nozzles [See Figure 8]
- Master streams [300 g.p.m. to 1,000 g.p.m.] [See Figure 9]
- Elevated aerial streams
- Standpipe systems
- Automatic sprinkler systems



Figure 8 - Examples of Handline Nozzles

The amount of water being supplied is dependent on hose size diameter. For supply hose the diameters are between 2 ½" to 5". Other important considerations are the pump capacity. Most pumper capacities are between 750 g.p.m. and 2,000 g.p.m. One other item is the effectiveness and/or size of the water supply.

### Attack lines

Attack lines are those fire hoses that will be taken into the structure to control and extinguish the fire. The size of the attack line depends on the following items size of available hose on the pumper, size of the fire, and the amount of water available to fight the fire. The purpose of attack lines are to confine the fire, protect exposures, and extinguish the fire.

The attack lines can either be of small diameter, 1 ½" to 2" diameter hose or medium diameter, 2 ½" to 3" diameter hose. These hoselines are attached to the following types of nozzles. [See Figure 8]

- Solid stream nozzles - solid stream of water discharges from the nozzle
- Fog stream nozzles - water discharge in a water spray pattern
- Master stream nozzles - discharge water in a solid or fog stream and can produce flows from 300 g.p.m. to 1,000 g.p.m.



**Figure 9** - Masterstream Device

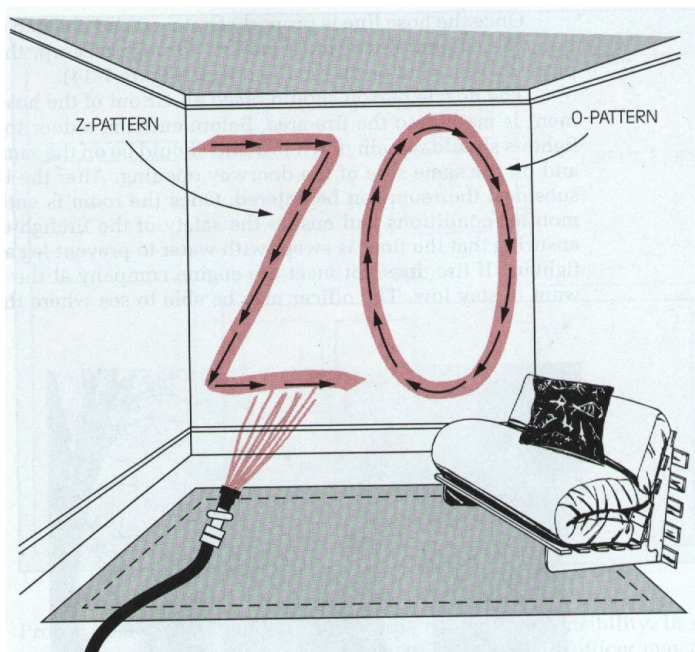
### Types of fire attack

The attack on the fire can be accomplished using one of two methods, **direct attack** or **indirect attack**. The **direct attack** is used for incipient stage fires or free burning stage fire prior to flashover occurring. Water is applied directly on to the fire until the flame “darkens” down [flame ceases]. The **indirect attack** is a method used in the free burning or steady state phase and during post flashover fires. Firefighters are usually unable to advance into the structure or fire area due to extreme heat and fire conditions. The water is applied to the heated overhead in an attempt to cool the heated gases using a narrow to medium water fog pattern. The small droplets of water absorb the heat, and generate steam, thus cooling the overhead. The firefighter usually moves the hose stream in a circular or a “Z” shaped pattern to cover as much area as possible. Water is applied until the fire “darkens” down [flames ceases]

Handline when making the attack should use the following priorities. The first hoseline to the avenue of fire spread to prevent extension, the second hoseline to the seat of the fire, and the third hoseline to the exposures, interior or exterior. These hoselines should be used to control interior stairs, separate the fire from the victims, and protect personnel.

The attack lines also aid the following functions

- Forcible entry - protects firefighters as they open doors so fire will not flash out at them
- Ventilation - prevents the spread of fire once the ventilation opening has been made due to the influx of oxygen in to the fire area
- Search - protects the search team as they perform their search of the structure



**Figure 10** - Types of Indirect Attack

## COORDINATION OF OPERATIONS

In order for a fire to be successfully extinguished the attack must be coordinated. An uncoordinated attack can lead to the following.

- Death or injury to firefighters
- Increase the magnitude of the fire
- Spread the fire throughout the structure or to nearby exposures
- Cause unnecessary damage

Hoselines should not oppose one another during a fire attack. In order for the attack to be successful the attack needs to be coordinated. For the coordination to be successful certain functions need to be in step with other functions, some of these are:

- Ventilation
  - Hoselines charged and in place
  - Water supply needs to be established for hoselines
  - Ladders raised to allow for access to the upper areas for possible ventilation
- Search
  - Ladders need to be raised to provide secondary means of escape
  - Ventilation should be accomplished prior entry to prevent the occurrence of a backdraft
- Attack lines
  - Ventilation accomplished prior to entry so as to make visibility better and fire area more tenable
  - Forcible entry needs to be accomplished so entry with hoselines can be accomplished
  - Ladders need to be raised so secondary access points and escape points are available
  - Water supply needs to be established

## PLACEMENT OF APPARATUS

Placement of fire apparatus at an emergency incident is critical. In most cases once the apparatus is positioned it is not advisable to move it except under those circumstances where personnel safety will be compromised. Some considerations to apparatus placement are the following.

- Apparatus capabilities
- Standard Operating Procedures
- Orders from the Incident Commander [ IC ]
- Prearranged placement based on pre-incident planning
- Location of fire and size
- Apparatus staged with personnel assigned
- Overhead hazards must also be considered

## FLAMMABLE LIQUID FIRES [See Figure 11]

Due to the extreme dangers of flammable liquid fires the approach is somewhat different than structural fires. The types of extinguishing agents used also affects the firefighting operations. Flammable liquid incidents are usually:

- Spill - large and small
- Burning fuel - spills and tanks or containers

### Small fires

- Can be controlled by dry chemical extinguishers or dry chemical wheeled units
- Foam applied to the spill. Make sure the right foam product is used on the right burning liquid [regular foam for petroleum products and alcohol type concentrate for polar solvent liquids]

### Large fires

- Usually require larger amounts of foam be used
- Make sure the right foam product is used on the right burning liquid [regular foam for petroleum products and alcohol type concentrate for polar solvent liquids]
- Proper amount of foam is used based on the square footage of the burning spill or tank



**Figure 11** - Example of Fighting Flammable Liquid Fire

## VEHICLE FIRES [See Figure 12]

This category includes passenger vehicles and transport vehicles. This discussion will be on passenger vehicles. The type of attack will depend on the location of the fire within the vehicle - engine compartment, passenger compartment, or storage compartment [trunk]. The same basic concepts apply as to structure fires - locate the fire, confine the fire, and extinguish the fire.

Some hazards to consider in fighting vehicle fire include

- Flammable liquids
- Toxic gases
- Limited water supply
- Potential rupture of closed containers [bumpers, struts, power steering and air conditioning hose lines, and tires]
- Corrosive materials

Because this type of fire has been considered a “nuisance” fire in the past, firefighters tend to be complacent at times. Some safety rules for fighting fires are:

- Approach the fire from upwind
- Approach the vehicle from the sides, not the ends
- Wear full protective clothing

The attack will depend on the size and location of the fire.

- Small fire can be extinguished with portable extinguishes
- Large fire need the use of 1 ½” attack lines or larger [100 g.p.m. to 150 g.p.m.]



**Figure 12** - Example of Fighting a Vehicle Fire