Note Taking Guide

Engine Company Fireground Operations

Maryland Fire and Rescue Institute
University of Maryland
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The Maryland Fire and Rescue Institute of the University of Maryland is the State's comprehensive training and education system for all emergency services.

The Institute plans, researches, develops, and delivers quality programs to enhance the ability of emergency service providers to protect life, the environment, and property.

Engine Company Fireground Operations

Lesson 1-1
Introduction

Maryland Fire and Rescue Institute

Student Performance Objective

- Given information from discussion, handouts, reading materials, and lecture the student will be able to identify tactical objectives of the engine company on the fireground using the knowledge of fire spread and dangerous conditions created to a written test accuracy of 70%.

FIRE 202-PPT-1-1-1

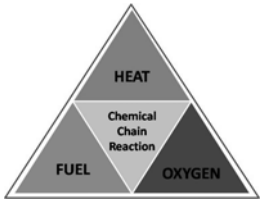
Overview

- Fire Spread
- Dangerous Conditions
- Engine Company Operations

FIRE 202-PPT-1-1-2

Fire Spread

- Fire Tetrahedron
  - Oxygen
  - Fuel
  - Heat
  - Chemical Reaction



FIRE 202-PPT-1-1-3

Fire Spread

- Convection
  - Is the travel of heat through the motion of heated matter
  - Causes the movement of heat and smoke to be predictable
    - During the convection cycle
      - Gases rise to the top
      - Heated air rises to replace cool air
      - Cool air is then heated and also rises
    - Smoke will fill the top of the building first

FIRE 202-PPT-1-1-4

Fire Spread

- Convection (continued)
  - Convection is the main reason ventilation is required
- Radiation
  - Is the travel of heat through space
  - Causes heat to travel from the fire in all directions in straight lines

FIRE 202-PPT-1-1-5

Fire Spread

- Radiation
  - Is the greatest cause of exposure fires
  - Causes the temperature of air and combustible materials to rise quickly
    - Flashover may occur long before flames contact fuel
    - Use proper ventilation to remove smoke, hot air, and gases
    - Radiant heat will only be counteracted by the application of water

FIRE 202-PPT-1-1-6

Fire Spread

- Conduction
  - Is the travel of heat through a solid body
    - Walls
    - Floors
    - Pipes
    - Metal joists
    - Masonry

FIRE 202-PPT-1-1-7

Fire Spread

- Conduction
  - Is especially dangerous when structures have steel roof supports that are completely exposed
    - Steel can expand up to 9 inches per 100 feet at 1,000 degrees
    - Applying water to steel members causes them to cool quickly and return to their original form

FIRE 202-PPT-1-1-8

Dangerous Conditions

- Flashover
  - Is the ignition of combustibles in an area heated by convection, radiation, or a combination of the two
  - Could be a sudden ignition followed by a rapid spread of fire to the entire area
  - May be caused by ignition some distance from the fire

FIRE 202-PPT-1-1-9

Dangerous Conditions

- Rollover
  - Occurs when unburned products of combustion accumulate at the ceiling level and ignite when given the sufficient concentration
  - Could be caused by convection

FIRE 202-PPT-1-1-10

Dangerous Conditions

- Smoldering Fire/Backdraft
  - Is caused by a fire being deprived of oxygen (incomplete combustion)
  - Produces carbon monoxide
    - Flammable
    - Odorless
    - Colorless
  - Causes violent explosions and/or rapid fire spread
  - Is controlled by proper ventilation and fire attack

FIRE 202-PPT-1-1-11

Engine Company Operations

- The Incident Management System (IMS)
  - Is an organized system of roles, responsibilities and procedures used to effectively mitigate emergency operations
  - Is used to define roles and responsibilities of each engine company
    - Life Safety
    - Incident Stabilization
    - Property Preservation

FIRE 202-PPT-1-1-12

Engine Company Operations

- Strategy and Tactics
  - Complete a proper size up
  - Complete pre-incident planning and inspection
  - Know your apparatus
  - Know your area

FIRE 202-PPT-1-1-13

Student Performance Objective

- Given information from discussion, handouts, reading materials, and lecture the student will be able to identify tactical objectives of the engine company on the fireground using the knowledge of fire spread and dangerous conditions created to a written test accuracy of 70%.

FIRE 202-PPT-1-1-14

Review

- Fire Spread
- Dangerous Conditions
- Engine Company Operations

FIRE 202-PPT-1-1-15

Engine Company Fireground Operations

Lesson 1-2
Equipment and Initial Hose Operations

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Student Performance Objective

- Given information from discussion, handouts, reading materials, and lecture the student will identify and describe equipment and initial hose operations for engine companies on the fireground to a written test accuracy of 70%.

FIRE 207-PPT-1-2-1

Overview

- Engine Company Equipment
- Single Pumper Hose Lays

FIRE 207-PPT-1-2-2

Engine Company Equipment

- Apparatus
  - Is governed by NFPA 1901
  - Is designed to transport personnel and equipment to support the suppression of fires and mitigate hazardous situations
  - Must have pumps with at least 750 gpm capacity
  - Must have tanks with at least 300 gallons of water

FIRE 207-PPT-1-2-3

Engine Company Equipment

- Hose Storage
  - Store $2^1/_2$ inch or larger hose in a minimum area of 30 cubic feet
  - Store $1^1/_2$ pre-connected hose lines in a minimum of two areas no less than 3.5 cubic feet each
  - Store in divided hose beds
    - Allows for dual lines to be laid
    - Allows for two different set ups: forward or reverse

FIRE 207-PPT-1-2-4

Engine Company Equipment

- Fire Hose
  - Carried on apparatus must be a minimum of 400 feet of $1^1/_2$, $1^3/_4$, or 2 inch hose
    - $1^3/_4$ is the most widely used for attack lines
    - Smaller hoselines can be advanced quickly
  - May be deployed from either side of the pumper using crosslays
  - Should not exceed 250 feet if pre-connected

FIRE 207-PPT-1-2-5

Engine Company Equipment

- Fire Hose
  - Of $2^1/_2$ inches should be used for heavy fire conditions
  - Of $3^1/_2$ inches or greater is considered large diameter hose (LDH)
    - LDH provides movement of large amounts of water
    - LDH is primarily used for supply line
    - LDH is the most effective means of moving water with minimal friction loss

FIRE 207-PPT-1-2-6

Engine Company Equipment

- Fire Hose
  - Soft sleeve or soft suction hose is required to make a quick connection to a hydrant or other pressurized water source
  - Hard sleeve or hard intake hose is primarily used to draft water from static water sources such as pools, lakes, or portable water tanks in shuttle operations

FIRE 207-PPT-1-2-7

Engine Company Equipment

- Nozzles
  - Are designed to shape the stream of water
  - Are required by NFPA
    - One combination fog nozzle at 200 gpm
    - Two combination fog nozzles at 95 gpm
    - One pipe with shutoff with 1, $1^1/_8$, and $1^1/_4$ tips

FIRE 207-PPT-1-2-8

Engine Company Equipment

- Nozzles
  - Solid stream nozzles
    - Solid stream nozzles are classified according to the diameter of the tip
      - $1^1/_8$ or $1^1/_4$ tip are used on handlines
      - $1^1/_4$ tips are the breaking point for handlines and streams at 50 psi versus 80 psi
    - Use a $1^1/_8$ inch nozzle on a $2^1/_2$ inch hose to produce 250 gpm at 45 psi

FIRE 207-PPT-1-2-9

Engine Company Equipment

- Nozzles
  - Solid stream nozzles
    - Use tips from $1^1/_4$ to 2 inches on master stream devices
    - Are used where range and penetrating capabilities are needed

FIRE 207-PPT-1-2-10

Engine Company Equipment

- Nozzles
  - Spray or Fog nozzles
    - Vary the degree of the angle of spray
    - May have pre-determined settings: Straight, 30°, 60°, and 90°
    - Are usually rated at 100 gpm
      - Some flow at different rates at different angles
      - Some flow at constant rates
    - Are more effective in quickly absorbing heat than straight streams

FIRE 207-PPT-1-2-11

Engine Company Equipment

- Nozzles
  - Master Stream Devices
    - Could be portable units that are mounted on or detached from the pumper
    - Should flow at least 1,000 gpm
    - Could be pre-connected or pre-piped
      - Have a separated discharge on the pump panel
      - Could have a 360 degree swivel, or up, down, or telescoping features

FIRE 207-PPT-1-2-12

Engine Company Equipment

- Pump Intake Connections
  - Are required by NFPA 1901
    - Must have the number of intakes to match the rate of the pump
    - Must have intakes equal in size to the suction lines
  - Are used in conjunction with soft sleeves for hydrant operations and hard sleeves for drafting operations
  - Could be on the front, rear, or side of the apparatus
    - Front and rear are good for positioning
    - Front is better for drafting

FIRE 207-PPT-1-2-13

Engine Company Equipment

- Hydrant Assist Valves
  - Are also known as four-way valves
  - Allow a second pumper to hook up to the hydrant without shutting the hydrant down
  - Are very useful in areas where pumpers have long response or delayed response

FIRE 207-PPT-1-2-14

Engine Company Equipment

- Ball Valves
  - Have an internal plastic component shaped like a ball that allows water to flow through it when the valve is open
  - Can be placed on a hydrant to allow additional supply lines to be laid without shutting down a hydrant
- Double-Male/Double-Female Couplings
  - Are used to connect two threaded connections of the same size and sex
  - Are used when a pumper is set up for a forward lay and uses a reverse lay

FIRE 207-PPT-1-2-15

Engine Company Equipment

- Ground Ladders
  - Are required per NFPA 1901
    - One straight ladder equipped with roof hooks
    - One extension ladder
    - One attic ladder
  - Can be used to support hoseline operations

FIRE 207-PPT-1-2-16

Single Pumper Hose Lays

- The Forward Lay Using a Charged Supply Line
  - Is the most desirable
  - Enables the engine company to function independently
  - Allows for uninterrupted water supply from the beginning of the operation
  - Allows for quick positioning
  - Permits the use of various size hoselines and possibly a master stream device if the water supply operation is sufficient

FIRE 207-PPT-1-2-17

Single Pumper Hose Lays

- The Forward Lay Using an Uncharged Supply Line
  - Is used if the second-arriving company is arriving quickly after the first engine
  - Requires good radio communication between engine companies
  - Is useful when narrow driveways or limited access may be detrimental to operations

FIRE 207-PPT-1-2-18

Single Pumper Hose Lays

- Direct-to-Fire, No-Line-Laid Approach
  - Requires the first pumper to go directly to the fireground without laying a supply line
  - Is only effective if a second pumper is directly behind the first-arriving pumper or extremely close
  - Requires the second pumper to lay an adequate amount of supply line from the first pumper to the hydrant
  - Is effective in areas that have no hydrant systems

FIRE 207-PPT-1-2-19

Single Pumper Hose Lays

- Reverse Lay Using a Charged Line
  - Requires laying hose from the fire to the hydrant
  - Allows for easier access by aerial companies to the fire building
  - Does not get water onto the fire as fast as other operations using pre-connected hoselines
  - Requires that all equipment needed for firefighting operations be removed before the pump is connected to the hydrant

FIRE 207-PPT-1-2-20

Student Performance Objective

- Given information from discussion, handouts, reading materials, and lecture the student will identify and describe equipment and initial hose operations for engine companies on the fireground to a written test accuracy of 70%.

FIRE 207-PPT-1-2-21

Review

- Engine Company Equipment
- Single Pumper Hose Lays

FIRE 207-PPT-1-2-22

Engine Company Fireground Operations

Lesson 2-1
Apparatus Positioning

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Student Performance Objective

- Given information from discussion, handouts, reading materials, and lecture the student will be able to identify the correct placement of engine companies on the fireground considering the tactical objectives of the scene to a written test accuracy of 70%.

FIRE 207-PPT-2-1-1

Overview

- Pre-Incident Plans
- Basic Coverage Responsibilities
- Problem Buildings

FIRE 207-PPT-2-1-2

Pre-Incident Plans

- Are developed by gathering data used by responding personnel to determine the resources and actions necessary to mitigate anticipated emergencies at a specified facility

FIRE 207-PPT-2-1-3

Pre-Incident Plans

- Are governed by NFPA 1620
- Should be coordinated with incident management systems
- Should include details on items such as
  - Construction
  - Occupant characteristics
  - Protection systems
  - Structural size and complexity
  - Presence of chemicals

FIRE 207-PPT-2-1-4

Basic Coverage Responsibilities

- Basic coverage responsibilities are usually defined in an AHJ's SOPs/SOGs
- Basic coverage responsibilities are assigned by the first-arriving officer or incident commander
  - Front of the building – first-arriving engine company
    - Buildings could have more than one main entrance
    - Command will designate "Side Alpha"
    - The other sides are named clockwise: Bravo, Charlie and Delta

FIRE 207-PPT-2-1-5

Basic Coverage Responsibilities

- Front of the building – first-arriving engine company
  - Pull forward on a single family to observe more than one side
  - On warehouses, apartments, and factories position so the fire can be attacked from the entrances
  - On attached buildings pull just past or short of the building to allow access for the first-arriving ladder company

FIRE 207-PPT-2-1-6

Basic Coverage Responsibilities

- Rear of the building – second-arriving engine company
  - Use alleys, service roads, or driveways to get into position
  - Allow room for ladder companies to come to the rear
  - If it is necessary to position in front, do not block the entrance or access to the rear of the building

FIRE 207-PPT-2-1-7

Basic Coverage Responsibilities

- Sides of the building
  - If one or both sides of a building are exposed ensure they are covered
  - Once all interior stairwells and corridors have been covered, additional hoselines can advance from the side
  - Always use a coordinated attack with side operations to avoid opposing hoselines
  - Make safety a priority

FIRE 207-PPT-2-1-8

Problem Buildings

- Set-back buildings create a positioning problem
  - The building may be too far back to position at the entrance
  - Trees, walls, or fences may prohibit proper positioning
  - First-arriving engines should position as close as possible to the building (wind conditions permitting)
  - Second-arriving engines should be directly behind the first and proceed with tools to the rear of the building

FIRE 207-PPT-2-1-9

Problem Buildings

- The design, layout, and construction of shopping malls hinders some tactical operations for individual stores
  - Hoselines can be carried through buildings with little problem
  - There are several roads and parking lots, creating access points to the front and rear of stores
  - If no standpipes are available for use, extremely long attack lines can be used

FIRE 207-PPT-2-1-10

Problem Buildings

- Standard shopping centers are usually attached blocks of buildings
  - Front and rear coverage is necessary
  - Sometimes rear doors and windows allow for easy access
  - Sometimes rear doors and windows are limited in size and could be barred or made of steel
  - Walls may need to be breached to gain entry

FIRE 207-PPT-2-1-11

Problem Buildings

- Mercantile areas have utilities that pass from store to store at the rear
  - Cover rear
  - Attack fire from the unburned side

FIRE 207-PPT-2-1-12

Problem Buildings

- All of the apartments in a garden apartment building cannot be seen from any one side of the building
  - Sometimes garden apartments are limited to three or four stories
  - The construction does little to stop the fire spread
  - Both front and rear must be covered
  - Rear access may be limited
    - Lay long lines to the fire area if necessary
    - Position pumpers near the ends of the buildings

FIRE 207-PPT-2-1-13

Problem Buildings

- In central corridor construction, only half of the rooms are visible
  - The sides of the building may need to be covered
  - Rear access may be limited but the rear must be covered

FIRE 207-PPT-2-1-14

Problem Buildings

- High-rise buildings have special tactical considerations that need to be identified
  - First-arriving engine position to have front access
  - First-arriving engine must have access to standpipe inlets and outlets
  - Other units are positioned according to command

FIRE 207-PPT-2-1-15

Student Performance Objective

- Given information from discussion, handouts, reading materials, and lecture the student will be able to identify the correct placement of engine companies on the fireground considering the tactical objectives of the scene to a written test accuracy of 70%.

FIRE 207-PPT-2-1-16

Review

- Pre-Incident Plans
- Basic Coverage Responsibilities
- Problem Buildings

FIRE 207-PPT-2-1-17

Engine Company Fireground Operations

Lesson 2-2
Rescue

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Student Performance Objective

- Given information from discussion, handouts, reading materials, and lecture the student will be able to define the timeline of a rescue situation and coordinate a fire attack with rescue to a written test accuracy of 70%.

FIRE 207-PPT-2-2-1

Overview

- The Chronology of Rescue
- Fire Attack for Rescue
- Searches

FIRE 207-PPT-2-2-2

The Chronology of Rescue

- Before the Alarm
  - Know your area
  - Know the hazards
  - Know potential rescue problems
  - Know your pre-incident plans

FIRE 207-PPT-2-2-3

The Chronology of Rescue

- Receipt of the alarm
  - The type of dispatch could be an indication of a potential rescue
    - Type of occupancy
    - Time of day
    - Keywords or phrases
      - "Next to"
      - "Across from"
      - "To the rear of"
      - "At the intersection of"

FIRE 207-PPT-2-2-4

The Chronology of Rescue

- Receipt of the alarm
  - Residential properties always include the possibility of a rescue situation
  - Offices, schools, and large stores that have high occupancy during the daytime present the probability of a daytime rescue

FIRE 207-PPT-2-2-5

The Chronology of Rescue

- At the fire scene
  - Question bystanders to determine whether anyone may still be in the building
  - Begin a primary search of the fire building
    - Perform immediate rescue without coordination of the fire attack should be used only in extreme cases
    - Second-arriving units would establish water supply as first-arriving units attempt an immediate rescue

FIRE 207-PPT-2-2-6

The Chronology of Rescue

- At the fire scene
  - Begin a primary search of the fire building
    - Ensure all personnel on the fireground are aware that a primary search is being conducted
    - Conduct a secondary search after the primary to determine if anything was missed during the primary search

FIRE 207-PPT-2-2-7

The Chronology of Rescue

- At the fire scene
  - Use ladder or tower units to remove victims from upper floors
  - Abide by the two-in/two-out rule as governed by OSHA and NFPA 1500
    - While two people are inside two people must be outside the hazard area
    - The two-out people should be in full PPE ready to initiate aid to the two-in

FIRE 207-PPT-2-2-8

The Chronology of Rescue

- At the fire scene
  - Use a rapid intervention team (RIT) or rapid intervention crew (RIC) to assist if the need arises to rescue any fire department personnel
    - RITs/RICs must have all necessary equipment to attempt a rescue of fire department personnel or civilians
    - RITs/RICs must stage in a location to maximize their options

FIRE 207-PPT-2-2-9

The Chronology of Rescue

- At the fire scene
  - Use water to assist in primary search and rescue, ventilation, and occupant rescue
    - Separate fire from the occupants by placing hoselines in strategic locations
    - Control interior stairways and corridors for evacuating occupants and advancing firefighters
    - Protect firefighters performing primary search, ventilation, and extinguishment around, above and below the fire

FIRE 207-PPT-2-2-10

The Chronology of Rescue

- At the fire scene
  - Use water to assist in primary search and rescue, ventilation, and occupant rescue
    - Assure continuous flow of water by laying supply lines
    - Put fire streams in service as soon as possible to attack the main body of the fire
    - Use streams to keep the fire from the occupants
  - Ventilate the building involved as soon as possible, but coordinate with the overall fire attack

FIRE 207-PPT-2-2-11

Fire Attack for Rescue

- In single family dwellings
  - Attack the fire immediately with adequate hoselines and water supply
  - Begin to ventilate over the fire and search for possible victims

FIRE 207-PPT-2-2-12

Fire Attack for Rescue

- In single family dwellings
  - If an attack line is available, take it to the fire floor: do not begin a search without it
  - Open windows and doors of other rooms to provide ventilation only if this will not spread the fire: heat and smoke will dissipate

FIRE 207-PPT-2-2-13

Fire Attack for Rescue

- In multiple family residences
  - Note the location of the fire and the smoke above it during size up
    - Indicates the area in which the fire is likely to spread
    - Indicates the area of greatest danger to the occupants
  - Pull hoselines to hit the main body of the fire, cut off the spread of the fire, and cover areas the fire is likely to spread to

FIRE 207-PPT-2-2-14

Fire Attack for Rescue

- In multiple family residences
  - Protect open stairwells
  - Search above the fire floor for occupants in distress as soon as possible; not without a hoseline in place
  - Use the proper size hose for the amount of fire present

FIRE 207-PPT-2-2-15

Fire Attack for Rescue

- In hospitals, schools, institutions
  - Search and rescue may be compounded by a large number of people
  - First-arriving companies may need to immediately assist people from the building to a safe location

FIRE 207-PPT-2-2-16

Fire Attack for Rescue

- In hospitals, schools, institutions
  - Officers shouldn't hesitate to call for assistance
  - Fire protection systems should be used to your advantage
    - Hook to a FDC and supply water
    - Use the standpipe systems on multiple floors
  - Schools should be completely evacuated

FIRE 207-PPT-2-2-17

Fire Attack for Rescue

- In fire-resistant buildings
  - Use $2^1/_2$ inch hoselines in any fire-resistant building
  - Pay attention in hallways and corridors where occupants could have attempted self rescue

FIRE 207-PPT-2-2-18

Searches

- Conduct searches in every fire where it is safe for firefighters to enter the structure
- Conduct searches with safety being the highest priority
- Coordinate searches with fire attack
  - Position hoselines between the fire and the occupants
  - Firefighters on hoselines closer to the floor can see some clear area above the fire floor

FIRE 207-PPT-2-2-19

Searches

- Communicate the status of searches to every-one on the fireground
- Coordinate searches with ventilation tactics
  - Place ladders in strategic locations
  - If deteriorating conditions exist firefighters completing ventilation should be instructed to assist search personnel

FIRE 207-PPT-2-2-20

Searches

- Conduct searches using a specific pattern defined by SOPs/SOGs
  - Search directly over the fire
  - At the top of the stairwell turn in one direction to access the area directly over the fire
  - Continue to search in the same direction when going in and out of every room
    - If the first turn is right, all turns will be right
    - The pattern stays the same until you reach the stairs again

FIRE 207-PPT-2-2-21

Searches

- Search all areas
  - Hallways or corridors
  - Open areas
  - Behind furniture
  - In bathtubs
  - Under and over beds

FIRE 207-PPT-2-2-22

Searches

- Conduct searches using tools to search areas away from walls
- Conclude searches with standard indicators that rooms have been searched
  - Small furniture in the doorway
  - Tagged doors
  - Chalk marks on the floor in front of the room or door
- Conduct searches in other structures using similar guidelines

FIRE 207-PPT-2-2-23

Student Performance Objective

- Given information from discussion, handouts, reading materials, and lecture the student will be able to define the timeline of a rescue situation and coordinate a fire attack with rescue to a written test accuracy of 70%.

FIRE 207-PPT-2-2-24

Review

- The Chronology of Rescue
- Fire Attack for Rescue
- Searches

FIRE 207-PPT-2-2-25

Engine Company Fireground Operations

Lesson 2-3
Initial Attack

Maryland Fire and Rescue Institute

Student Performance Objective

- Given information from discussion, handouts, reading materials, and lecture the student will be able to select the proper type of attack line for specific incidents based on conditions present to a written test accuracy of 70%.

FIRE 207-PPT-2-3-1

Overview

- Types of Attack
- Choosing Attack Lines
- Initial Attack Operations
- Smoldering Fire

FIRE 207-PPT-2-3-2

Types of Attack

- A Direct Attack
  - Is the surest way of controlling a fire
  - Is the best way to minimize danger to occupants
  - Delivers water to the base of the fire using a solid or straight stream
  - Cools the burning materials below ignition temperature
  - Must be coordinated with truck companies performing ventilation

FIRE 207-PPT-2-3-3

Types of Attack

- An Indirect Attack
  - Uses a solid or straight stream directed at the ceiling to cool superheated gases in upper levels of a room
  - Prevents flashover by removing heat from the upper atmosphere
    - Water applied at the ceiling is turned into steam
    - Steam absorbs the heat and reduces the temperature

FIRE 207-PPT-2-3-4

Types of Attack

- An Indirect Attack
  - Could cause serious burns to firefighters or occupants
  - Makes rescue attempts more difficult
  - Should be ceased when enough water has been discharged to cool the area
    - A direct attack should be continued after the area is cooled
    - Ventilation is a key component to the drop in temperature

FIRE 207-PPT-2-3-5

Types of Attack

- A Combination Attack
  - Uses both direct and indirect attacks
  - Uses a limited amount of water during the indirect attack to limit the amount of steam produced

FIRE 207-PPT-2-3-6

Choosing Attack Lines

- The Size of Attack lines
  - Should be determined by the extent and location of the fire
  - Could be determined by manpower
    - Interior attack lines handled by one person is a dangerous situation
    - Handlines larger than $1^3/_4$ inches should be handled by at least two firefighters

FIRE 207-PPT-2-3-7

Choosing Attack Lines

- Water stream patterns and operation
  - Smooth bore nozzles produce solid streams which have more water delivery capability than straight streams
    - Solid streams are used for the safest and most effective interior operations
    - Solid streams aid in rescue
    - Solid streams are less likely to disrupt the thermal layer
    - Solid streams may help with visibility

FIRE 207-PPT-2-3-8

Choosing Attack Lines

- Water stream patterns and operation
  - Spray nozzles adjusted to a fog pattern should be used in unoccupied confined spaces
    - Used in heavy fire involvement the fog stream can be used to cool areas such as basements, attics, or cocklofts
    - Fog streams can be used when it is known the building is being adequately ventilated from behind
      - Fog patterns produce a combination of reach and protection for firefighters
      - Fog patterns absorb a lot of heat

FIRE 207-PPT-2-3-9

Choosing Attack Lines

- There are four types of spray nozzles for fog patterns
  - Basic Spray
  - Constant pressure
  - Constant gallonage
  - Constant/select gallonage

FIRE 207-PPT-2-3-10

Choosing Attack Lines

- Water stream patterns and operation
  - Effective stream operation
    - Use smooth bore nozzles on $1^3/_4$ and $2^1/_2$ inch pre-connected attack lines or adjust spray nozzles on the straight stream pattern
    - Conduct a risk versus benefit analysis before entering the building
    - Crack the nozzle to bleed air out of the line
    - Position all firefighters on the same side of the hoseline prior to entering the building and have them remain low

FIRE 207-PPT-2-3-11

Choosing Attack Lines

- Water stream patterns and operation
  - Effective stream operation
    - Be prepared to use a direct attack to deliver water on the fire
    - Stay low when entering the fire area; let the heat and heated gases vent
    - Do not open the nozzle until fire can be seen unless firefighter safety is involved
    - If fire is prevalent at the top of a door as it is opened, the ceiling should be hit with a solid stream to cool it and control fire gases

FIRE 207-PPT-2-3-12

Choosing Attack Lines

- Water stream patterns and operation
  - Effective stream operation
    - Direct the stream at the base of the fire if it is localized
    - As advancement is complete, direct the angle of the stream toward the base of the fire for full extinguishment
    - Sweep the stream toward the floor to extinguish burning debris
    - When the main body of the fire is extinguished, shut the line down to let the area “blow”
    - When the fire is completely knocked down shut down the attack line to prevent excess water damage and water weight on the floor

FIRE 207-PPT-2-3-13

Choosing Attack Lines

- The number of lines used depends upon
  - The size and severity of the fire
  - The location and type of building
  - The number of exposures
- Master streams
  - Could be used as initial attack on large incidents
  - Could be used when a structure is too dangerous for firefighters to enter
  - Can be directed from a piece of apparatus with a portable device

FIRE 207-PPT-2-3-14

Initial Attack Operations

- Attack Lines
  - Are used to control the fire quickly
  - Should be advanced immediately to protect occupants, assist in rescue, and cut off vertical spread
  - Must be larger in diameter for large spaces and fires
    - Commercial spaces with more than 50% involvement use a $2^1/_2$ inch attack line
    - In storage areas where fires have gained considerable headway, consider larger hoselines

FIRE 207-PPT-2-3-15

Initial Attack Operations

- Attack Lines
  - Use attack lines to protect means of egress for occupants and firefighters
    - Use a $1^3/_4$ or $2^1/_2$ inch attack line in basements, protecting stairs
    - Basements with concrete walls have no means of venting; use a $2^1/_2$ inch smooth bore nozzle from an outside doorway
  - Select attack lines based on fire size
    - When a fire has gained control of an area use a larger hoseline
    - Use smaller lines to protect floors above, around, under, and areas next to the fire from possible extension

FIRE 207-PPT-2-3-16

Initial Attack Operations

- Advancing attack lines in multi-story buildings
  - Attack lines must be advanced up to and above the floor
  - Hoselines above the fire floor are used to protect the primary search and extinguish vertical spread
  - Use the standpipe system to stop spread to stairwells
  - Use means to advance hoselines to upper floors other than the stairwells
    - Use ground ladders, aerial ladders, and aerial platforms
    - Hoist with ropes
    - Carry through the building and then connect to an outside hose
    - Pass up to a window with a pike pole or shepherd hook

FIRE 207-PPT-2-3-17

Initial Attack Operations

- Ventilation
  - Is key in all attack procedures
  - In stairwells and hallways is highly important
  - Can be done by an engine company advancing attack or back up lines
  - Should be done by a ladder or truck company simultaneously with the fire attack

FIRE 207-PPT-2-3-18

Smoldering Fire

- Indications of smoldering fire
  - Smoke is visible but flames are not from the outside
  - The smoke rises rapidly
  - Smoke leaves the building under pressure from around windows, doors, and other openings

FIRE 207-PPT-2-3-19

Smoldering Fire

- Indications of smoldering fire
  - Smoke may be yellow or dirty brown
  - No flames may be showing but the windows may be brown or stained from carbon deposits
  - Signs of extreme heat are present
  - Windows are darkened with linear cracks
  - Smoke will exit the building and then appear to be sucked back into the building

FIRE 207-PPT-2-3-20

Smoldering Fire

- Backdraft
  - Is the sudden ignition of the gases and preheated combustibles when oxygen is introduced into a superheated space previously deprived of oxygen
  - Engulfs the building in fire
  - Will blow out windows and possibly damage the structure

FIRE 207-PPT-2-3-21

Smoldering Fire

- Ventilation
  - Open the building at the highest point possible to release the gases and allow them to move out of the area
    - Do before attempting to enter the building
    - The explosive situation created by oxygen deprivation will be relieved
  - Ventilate fully and in the right places to ensure all gases are dispersed
    - Do not rush, but do promptly
    - Attack lines must be in place fully charged and ready to use

FIRE 207-PPT-2-3-22

Smoldering Fire

- Initial Attack
  - Should begin once venting is complete
    - Upon the introduction of oxygen, a smoldering fire may burst into flames
  - Should include several attack lines to be stretched around the fire
  - Includes search and rescue

FIRE 207-PPT-2-3-23

Student Performance Objective

- Given information from discussion, handouts, reading materials, and lecture the student will be able to select the proper type of attack line for specific incidents based on conditions present to a written test accuracy of 70%.

FIRE 207-PPT-2-3-24

Review

- Types of Attack
- Choosing Attack Lines
- Initial Attack Operations
- Smoldering Fire

FIRE 207-PPT-2-3-25

Engine Company Fireground Operations

Lesson 3-1
Back-Up Lines

Maryland Fire and Rescue Institute

Student Performance Objective

- Given information from discussion, handouts, reading materials, and lecture the student will be able to determine positioning of back-up lines based on existing conditions to a written test accuracy of 70%.

FIRE 207-PPT-3-1-1

Overview

- Positioning of Back-Up Lines
- Sizes of Back-Up Lines
- Use of Back-Up Lines

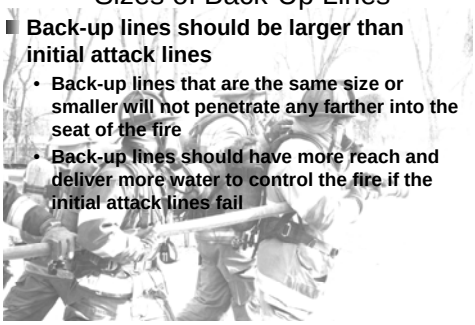
FIRE 207-PPT-3-1-2

Positioning of Back-Up Lines

- Position back-up lines
  - When the initial attack lines may not extinguish the fire quickly
  - To cover the same area as the initial attack lines (however, only use when needed)
  - To establish control of the fire if necessary

FIRE 207-PPT-3-1-3

Sizes of Back-Up Lines



- **Back-up lines should be larger than initial attack lines**
  - **Back-up lines that are the same size or smaller will not penetrate any farther into the seat of the fire**
  - **Back-up lines should have more reach and deliver more water to control the fire if the initial attack lines fail**

FIRE 207-PPT-3-1-4

Sizes of Back-Up Lines

- Back-up lines are determined by the size and number of initial attack lines
  - A back-up line for two $1^3/_4$ inch attack lines is one $2^1/_2$ inch line
    - Using another $1^3/_4$ inch line will only add to the water weight
    - Another $1^3/_4$ inch line will not control the fire effectively
  - A back-up line for a $2^1/_2$ inch attack line should be at least $2^1/_2$ inches with a larger tip
    - Smooth bore tips have greater water delivery
    - Smooth bore tips penetrate greater into the seat of a fire

FIRE 207-PPT-3-1-5

Sizes of Back-Up Lines

- If $2^1/_2$ inch lines are already in place and the fire is not being controlled, consider the use of master streams
  - Master streams must be available for back up lines
  - Appliances must be charged immediately if they are being used in the initial attack
  - Use an additional attack line to support the master stream devices

FIRE 207-PPT-3-1-6

Use of Back-Up Lines

- Use if the initial attack lines fail or do not extinguish the fire
- Use to gain control of the fire and begin advancement into the fire
- Man with an adequate number of personnel
  - Additional firefighters may be needed to man additional back-up lines when initial attack firefighters become tired (it is the IC's job to maintain adequate staffing)

FIRE 207-PPT-3-1-7

Student Performance Objective

- Given information from discussion, handouts, reading materials, and lecture the student will be able to determine positioning of back-up lines based on existing conditions to a written test accuracy of 70%.

FIRE 207-PPT-3-1-8

Overview

- Positioning of Back-Up Lines
- Sizes of Back-Up Lines
- Use of Back-Up Lines

FIRE 207-PPT-3-1-9

Engine Company Fireground Operations

Lesson 3-2
Master Streams

Maryland Fire and Rescue Institute

Student Performance Objective

- Given information from discussion, handouts, reading materials, and lecture the student will be able to identify the need for and use of master stream appliances to a written test accuracy of 70%.

FIRE 207-PPT-3-2-1

Overview

- Types of Master Stream Appliances
- Nozzles for Master Stream Appliances
- Water Supply for Master Stream Appliances
- Use of Master Stream Appliances

FIRE 207-PPT-3-2-2

Types of Master Stream Appliances

- Portable Master Stream Appliances
  - Are often referred to as deck guns or monitors
    - May have telescoping features
    - May be supplied with a separate discharge gate
  - On apparatus can usually be placed in service quickly

FIRE 207-PPT-3-2-3

Types of Master Stream Appliances

- Portable Master Stream Appliances
  - Can be removed from the apparatus and secured to the ground with chains or straps
    - When water flows the device may shift from its position
    - A safety lock is provided that needs to be released before the nozzle is lowered below 35 degrees
  - Should be supplied by LDH
  - Should be used according to the manufacturer's specifications

FIRE 207-PPT-3-2-4

Types of Master Stream Appliances

- Fixed Master Stream Appliances
  - Are permanently mounted or fixed to pumpers
  - Receive water in one of two ways
    - Water is pre-piped to the appliance from a separate discharge
    - Hoselines supply water with one or more connections to the pumper's discharge outlets
  - Must be properly positioned at the fire scene

FIRE 207-PPT-3-2-5

Types of Master Stream Appliances

- Elevated Master Stream Appliances
  - Are found on aerial ladders, elevated platforms and water towers
  - Are usually supplied by engine companies unless the apparatus has a fire pump
  - Must be able to flow at least 1,000 gpm at 100 psi at full elevation and extension
    - Elevating platforms of 110 feet or less must have a permanent water delivery system installed capable of delivering 1,000 gpm at 100 psi
    - One or more permanently installed monitors with nozzles capable of discharging 1,000 gpm must be provided on the platform

FIRE 207-PPT-3-2-6

Types of Master Stream Appliances

- Elevated Master Stream Appliances
  - Could be ladder pipes with clamps to secure the appliance to the ladder
  - Can be used to direct streams through windows or other openings in defensive operations

FIRE 207-PPT-3-2-7

Types of Master Stream Appliances

- Elevated Master Stream Appliances
  - Use a solid stream when possible
    - Will penetrate further into the building
    - Will not be affected by the wind
  - Do not direct streams into natural openings
    - Will spread smoke and gases
    - Could reverse ventilation

FIRE 207-PPT-3-2-8

Nozzles for Master Stream Appliances

- Use various sizes of smooth bore
- Are usually operated at 80 psi
- Do not operate properly when insufficient flow rates are used
- Could be spray nozzles that operate at 100 psi and vary from 300 to 1250 gpm
- Are only as good as their water supply

FIRE 207-PPT-3-2-9

Water Supply for Master Stream Appliances

- Master stream appliances operate at high flow rates, which increase friction loss and require higher pressures and increased water flow

FIRE 207-PPT-3-2-10

Water Supply for Master Stream Appliances

- Friction loss must be minimized
  - Locate a pumper at a hydrant sufficient to supply a master stream
  - In relay pumping operations use LDH or an adequate number of smaller lines
  - If the master stream device is operated away from the pumper ensure an adequate water supply to the device
  - Maintain a minimum distance between the pumper and device
  - Determine the number of adequate lines to keep friction loss low and flow rates high

FIRE 207-PPT-3-2-11

Use of Master Stream Appliances

- During initial attack
  - Appliances may need to be close to the building when using a straight stream
  - Solid streams may be useful in multi-story buildings
- During exposure protection use a fog pattern instead of a solid stream

FIRE 207-PPT-3-2-12

Use of Master Stream Appliances

- Back up initial attack lines
- Consider a straight stream rather than a fog pattern in heavy wind
  - A straight stream has better penetration capabilities
  - A straight stream covers more area of the building
- When moving water stream
  - The tip should be moved horizontally to cover the width of the fire and vertically to cover the depth of the fire
  - Less movement is required for exposure coverage

FIRE 207-PPT-3-2-13

Use of Master Stream Appliances

- For maximum effectiveness
  - Try repositioning for better penetration into the fire
  - Try changing the tip to increase the flow rate

FIRE 207-PPT-3-2-14

Student Performance Objective

- Given information from discussion, handouts, reading materials, and lecture the student will be able to identify the need for and use of master stream appliances to a written test accuracy of 70%.

FIRE 207-PPT-3-2-15

Review

- Types of Master Stream Appliances
- Nozzles for Master Stream Appliances
- Water Supply for Master Stream Appliances
- Use of Master Stream Appliances

FIRE 207-PPT-3-2-16

Engine Company Fireground Operations

Lesson 3-3

Exposure Protection and Basement Fires

Maryland Fire and Rescue Institute

Student Performance Objective

- Given information from discussion, handouts, reading materials, and lecture the student will be able to identify and determine the means by which to protect exposures and to fight basement fires to a written test accuracy of 70%.

FIRE 207-PPT-3-3-1

Overview

- Exposure Protection
- Exterior Exposure Fires
- Hoselines and Nozzles
- Interior Exposures
- Basement Fires

FIRE 207-PPT-3-3-2

Exposure Protection

- Is needed to shield separate buildings or other parts of buildings which have been subjected to radiant heat, convected heat or direct flame from the main body of a fire
- Should be a priority for any incident commander
- Is second only to rescue
- Can be identified in pre-incident planning

FIRE 207-PPT-3-3-3

Exposure Protection

- Can only be accomplished by an adequate number of personnel
  - Ladder companies can assist engine companies
  - Mutual aid may be needed

FIRE 207-PPT-3-3-4

Exterior Exposure Fires

- Are defined as fires that spread from one structure to another, from one independent part of a building to another, or from one wing of a building to another
- Can be influenced by several factors
  - Weather conditions
  - Spacing between the fire and the exposure
  - Building construction and design

FIRE 207-PPT-3-3-5

Exterior Exposure Fires

- Factors influencing exterior exposure fires (continued)
  - Intensity of the fire
  - Location of the fire
  - Availability and combustibility of fuel
  - Availability of personnel
  - Availability of equipment
  - Availability of water

FIRE 207-PPT-3-3-6

Exterior Exposure Fires

- Exterior exposure fires can be spread by convection
  - Wind conditions may increase exposure hazards
    - Lumber yards
    - Open storage areas
  - Look for exposures downwind from very large fires

FIRE 207-PPT-3-3-7

Exterior Exposure Fires

- Exterior exposure fires can be spread by radiant heat
  - Radiant heat will keep firefighters at a distance
  - Radiant heat will add exposure problems in all directions
  - The only way to protect an exposure from radiant heat is to cool it with the application of water
    - Radiant heat can pass through glass and ignite materials within a building
    - High-rise buildings should be protected from the exterior and checked for exposure from the interior as well

FIRE 207-PPT-3-3-8

Exterior Exposure Fires

- Exterior exposure fires are likely to occur on the leeward or downwind side of adjacent buildings
  - This is the area of convected radiant heat
  - This side should be covered first

FIRE 207-PPT-3-3-9

Hoselines and nozzles

- Must be the proper size and volume to control the spread of the fire
- Must have a sufficient volume of water to reach the exposure and penetrate fire if necessary
- Must be able to produce enough gpm to prevent ignition
- May not work and master stream devices may have to be used

FIRE 207-PPT-3-3-10

Hoselines and nozzles

- Must be large enough to withstand wind
- Should be placed in the area of most exposure
- Should protect firefighters from radiant heat

FIRE 207-PPT-3-3-11

Interior Exposures

- Keep the fire from spreading into uninvolved areas
- Cover with many positions inside the building to stop the spread

FIRE 207-PPT-3-3-12

Interior Exposures

- Fires can spread vertically or horizontally
  - Vertical spread
    - Fire spreads inside walls, partitions, pipe shafts, air shafts, etc.
    - Fire could spread inside shafts that carry building utilities
    - Look for signs of spread around the roof features
      - Blistering or discoloring of paint
      - Soft, shiny tar on roofs
      - Smoke or flames coming from the corners of walls

FIRE 207-PPT-3-3-13

Interior Exposures

- Vertical spread (continued)
  - Use a thermal imaging camera to assist in finding the fire
  - Place hoselines directly into shafts or roof openings where fire is known
  - Open the roof to encourage fire to travel vertically and slow horizontal travel
  - Use additional hoselines to control the fire from the inside by cooling hot gases and embers at the ceiling level
  - Use larger hoselines for larger openings

FIRE 207-PPT-3-3-14

Interior Exposures

- Horizontal spread
  - The fire spreads in spaces between ceilings, floors, hanging ceilings, ductwork, conveyor tunnels, etc.
  - Interior horizontal fire spread has the same indications as vertical fire spread
  - Horizontal fire spread is controlled in the same manner as vertical fire spread and exposure

FIRE 207-PPT-3-3-15

Interior Exposures

- Fires can be in concealed spaces
  - All spaces need to be opened and inspected visually
  - There is little choice but to destroy the building to inspect for fires in concealed spaces
  - Opening of concealed spaces and ventilation is typically done by a truck or ladder company

FIRE 207-PPT-3-3-16

Interior Exposures

- Fires can be in open spaces
  - Fire in open spaces can only be contained by the walls and roof of a building
  - Heat, smoke, and superheated gases contained by large open spaces will be a problem for firefighters
  - Consider exterior operations when the structural integrity is in question

FIRE 207-PPT-3-3-17

Basement Fires

- Are the most difficult and dangerous types of incidents
  - Limited entry and exits
  - Limited places for ventilation
- Should be attacked from the unburned side
- Should be fought with an attack line covering the stairs

FIRE 207-PPT-3-3-18

Basement Fires

- Should be attacked with hoselines in place at every opening
  - Windows
  - Doors
  - Trapdoors
  - Access chutes
- Also require the ventilation of the first floor
- Could have significant fuel load

FIRE 207-PPT-3-3-19

Basement Fires

- Need to have exposure protection
  - Sound the first floor before entering if on the first floor
  - Place hoselines on the first floor to prevent vertical spread
  - Place hoselines in the landings to knock down any fire that has spread already from the basement
  - Check all walls, partitions, and baseboards for horizontal and vertical spread

FIRE 207-PPT-3-3-20

Basement Fires

- May spread vertically
  - Open any vertical spaces on the first floor
  - Open the roof to allow for heat and smoke to leave
- May spread horizontally
  - Older structures are more susceptible to horizontal spread
  - Check adjoining basements and attic spaces

FIRE 207-PPT-3-3-21

Student Performance Objective

- Given information from discussion, handouts, reading materials, and lecture the student will be able to identify and determine the means by which to protect exposures and to fight basement fires to a written test accuracy of 70%.

FIRE 207-PPT-3-3-22

Overview

- Exposure Protection
- Exterior Exposure Fires
- Hoselines and Nozzles
- Interior Exposures
- Basement Fires

FIRE 207-PPT-3-3-23

Engine Company Fireground Operations

Lesson 4-1
Water Supply

Maryland Fire and Rescue Institute

Student Performance Objective

- Given information from discussion, handouts, reading materials, and lecture the student will be able to identify the tactical considerations involved in water supply to a written test accuracy of 70%.

FIRE 207-PPT-4-1-1

Overview

- Water Supply
- Water Sources
- Pumpers
- Fire Hose
- Supply Line Procedures

FIRE 207-PPT-4-1-2

Water Supply

- Water supply must be adequate and continuous on the fireground
- Operations must be carried out safely
- Operations should be carried out using a minimal number of firefighters

FIRE 207-PPT-4-1-3

Water Sources

- Water Main Systems
  - Are the major source of water for most departments
  - Are not controlled by fire departments
    - Engine companies must use what is available to them
    - Engine companies must know the flow rates of the systems they are working with
      - Pressure levels determine availability of water
      - Pressure levels allow the pump operator to estimate how many attack lines can be supplied by the water main system
        - Static pressure
        - Residual pressure

FIRE 207-PPT-4-1-4

Water Sources

- Water Main Systems
  - Could provide a less-than-adequate supply of water
    - Determine supply during pre-incident planning
    - Note where dead-end mains and small mains are
    - Consider the use of LDH in these areas

FIRE 207-PPT-4-1-5

Water Sources

- Static Water Sources
  - Are used in drafting operations to ensure an adequate water supply
  - Must be noted on pre-incident plans
    - Location of sources
    - Volume of water available
    - Distance to the structure involved

FIRE 207-PPT-4-1-6

Water Sources

- Apparatus Water Tanks
  - On first-arriving engines should be used until additional water supply is established
  - Cannot be run dry

FIRE 207-PPT-4-1-7

Water Sources

- Mobile Water Supply Apparatus
  - Are used for transporting water to emergency scenes
  - Generally carry between 1,000 and 3,500 gallons of water
  - Could be equipped with a pump
  - Can be used for water supply until a continuous source is obtained
    - May be used in tanker shuttle operations

FIRE 207-PPT-4-1-8

Water Sources

- Mobile Water Supply Apparatus (continued)
  - Number of tankers needed depends on
    - Distance from the fire to the water source
    - Size of the fire
    - How long it takes to fill the tank
    - How long it takes to dump the tank
    - Traffic
    - Road conditions
  - More modern tanks have large dump valves to allow for quicker offloading of water

FIRE 207-PPT-4-1-9

Pumpers

- Pumpers are fire apparatus with a fire pump of at least 750 gpm, a water tank, and a hose body whose primary purpose is to combat structural fires
- Pumpers have water delivery capacity limited by the capacity of the pump and by the number of suction intakes and discharges
  - 100% at 150 psi
  - 70% at 200 psi
  - 50% at 250 psi

FIRE 207-PPT-4-1-10

Pumpers

- Pumpers must have the intake capacity to match the pumping capacity
  - Intakes must be at least equal in size to the size of the suction lines
  - Intakes must have male NH threads in the U.S.
- Pumpers directly working with hydrants must have 10-20 feet of LDH
- Pumpers could have front and/or rear intakes

FIRE 207-PPT-4-1-11

Pumpers

- Pumpers use LDH for supply hose to reach the fire
  - Large-diameter hose moves water effectively
  - Use caution to prevent friction loss
- Pumpers use outlets that discharge water at the rated capacity of the pump
  - One $2^1/_2$ inch discharge per 250 gpm of rated capacity is unusually installed
  - Discharges could be located on either side, front or rear of the apparatus

FIRE 207-PPT-4-1-12

Pumpers

- Pumpers could deliver more than the rated capacity under certain conditions
  - Pumps cannot be operated above 80% of their rated peak speed for any length of time
  - If an increase in engine pump speed is not accompanied by an increase in discharge pressure the pump is moving as much water as it can

FIRE 207-PPT-4-1-13

Pumpers

- Residual pressures must be constantly monitored (Extremely important when several pumpers are drawing from the same hydrant system)
  - Maintain between 20 and 25 psi or more if possible
  - Notify the company officer immediately if residual pressure drops below 10 psi
  - Never lower the pressure or shut down a hoseline without the knowledge or consent of the operators of that hoseline
  - Shut down unmanned hoselines
  - Set up a supplemental supply line if pressure is lost

FIRE 207-PPT-4-1-14

Fire Hose

- Fire hose is the flexible conduit used to carry water
- Fire hose must be long enough and large enough to maintain adequate water supply
  - The larger the diameter of the hose, the less friction loss for a given rate
  - The greater the flow rate, the greater the friction loss
  - Use proper nozzle and pump pressures to overcome friction loss

FIRE 207-PPT-4-1-15

Fire Hose

- Fire hose is used by firefighters to attack fire beyond the incipient stage
  - Designed to carry water to various appliances
  - Designed to operate up to 275 psi
- Fire hose is used as supply line to move water between a pressurized source and a pump

FIRE 207-PPT-4-1-16

Fire Hose

- Fire hose with a $2^1/_2$ inch diameter is standard across the U.S.
  - Can be used for attack lines and for supplying master streams
  - Has a flow rate of 550 gpm when supplying two 1¾ inch attack lines
  - Used as a supply line directly from the hydrant the flow rate must not exceed 350 gpm
  - Using two $2^1/_2$ inch supply lines will decrease friction loss
    - 500 gpm would create 250 gpm in each line
    - Friction loss would only be 15 psi

FIRE 207-PPT-4-1-17

Fire Hose

- Fire hose with a 3-inch diameter is just as effective as that with $2^1/_2$ inch
  - Difference in friction loss is greater with single lines
  - Difference in friction loss is less with dual $2^1/_2$ lines and a single 3-inch line

FIRE 207-PPT-4-1-18

Fire Hose

- Fire hose with a diameter of more than $3^1/_2$ inches is considered LDH per NFPA 1961
  - Moves large amounts of water from one pumper to another
  - Moves water from a source to the fireground
  - Supplies attack lines
  - Provides the least amount of friction loss
    - One 4-inch LDH provides as much water as three and a half $2^1/_2$ lines
    - One 5-inch LDH provides as much water as six $2^1/_2$ lines

FIRE 207-PPT-4-1-19

Supply Line Procedures

- Begin with a forward or reverse lay
- Charge the supply line provided you're at a hydrant
- Begin tank operations as soon as possible if no supply line is laid
- Supplement the initial pumper's operation after another pumper arrives
- Begin pumping at the hydrant at 100 psi

FIRE 207-PPT-4-1-20

Supply Line Procedures

- Use a relay operation when laying lines longer than 1000 feet
  - Must be done quickly and efficiently
  - Involves two methods of set up
    - First-arriving pumper is at the scene, additional units lay hose from the scene to the water source
    - First-arriving pumper lays supply line from the entrance and begins the attack with tank water, additional units lay line from the entrance to the water

FIRE 207-PPT-4-1-21

Supply Line Procedures

- Begin relay pumping once all the pumpers are in place
  - Charge each pumper one at a time
  - The pump operator must keep the discharge gates fully open
  - All pumpers in relay operation should pump at 150 psi
  - Incoming pressure to the next pumper should never drop below 20 psi
  - Use good radio communications

FIRE 207-PPT-4-1-22

Supply Line Procedures

- If more water is needed another supply line should be laid between the operating pumpers

FIRE 207-PPT-4-1-23

Student Performance Objective

- Given information from discussion, handouts, reading materials, and lecture the student will be able to identify the tactical considerations involved in water supply to a written test accuracy of 70%.

FIRE 207-PPT-4-1-24

Review

- Water Supply
- Water Sources
- Pumpers
- Fire Hose
- Supply Line Procedures

FIRE 207-PPT-4-1-25

Engine Company Fireground Operations

Lesson 4-2
Fire Protection Systems

Maryland Fire and Rescue Institute

Student Performance Objective

- Given information from discussion, handouts, reading materials, and lecture the student will be able to identify, utilize, and supply standpipe systems for initial attack to a written test accuracy of 70%.

FIRE 207-PPT-4-2-1

Overview

- Standpipe Systems
- Fire Department Connections
- Fire Attack from Standpipe Systems
- Entering the Building
- Beginning Attack Operations
- Other Uses for Standpipe Systems
- Automatic Sprinkler Systems
- Setting Up Water Supply for Sprinkler Systems
- Other Protection Systems

FIRE 207-PPT-4-2-2

Standpipe Systems

- Are arrangements of pipes that carry water vertically and sometimes horizontally through a building
- Are used to prevent long hose lays
- Are governed by NFPA 14

FIRE 207-PPT-4-2-3

Standpipe Systems

- Standpipe systems have three classes
  - Class One (I)
    - Provides $2^1/_2$ inch hose connections at designated locations in the building for full scale firefighting
    - Should only be used by firefighters
  - Class Two (II)
    - Provides $1^1/_2$ inch hose connections at designated locations for first aid firefighting
    - Should be used by fire brigades and building occupants
  - Class Three (III)
    - Is a combination of Class I and II
    - Can be used for full-scale firefighting or first aid firefighting

FIRE 207-PPT-4-2-4

Standpipe Systems

- Standpipe systems consist of various types
  - Automatic Wet Systems
    - Have piping that is filled with water at all times
    - Have an automatically available water supply
  - Automatic Dry Systems
    - Have piping that is normally filled with pressurized air
    - Admit water into the system when valve is opened
    - Are connected to an automatically available water supply

FIRE 207-PPT-4-2-5

Standpipe Systems

- Semiautomatic Dry Systems
  - Have piping that is normally filled with pressurized or unpressurized air
  - Will only admit water into the system when a pull station is operated
  - Have a pre-connected water supply
- Manual Dry Systems
  - Have piping that is normally filled with air
  - Do not have a pre-connected water supply
  - Must use an FDC to maintain water supply

FIRE 207-PPT-4-2-6

Standpipe Systems

- Manual Wet Systems
  - Have piping that is normally filled with water for the purpose of finding leaks
  - Have a water supply provided by a small connection to domestic water piping
  - Must use an FDC

FIRE 207-PPT-4-2-7

Standpipe Systems

- Dry systems have
  - Vertical pipes or risers running through or along the outside of the building
    - Some may have multiple systems
    - Location of the intakes is important
  - At least one outlet on each floor
  - A fire department intake located on the outside of the building
  - At least one outlet on each landing

FIRE 207-PPT-4-2-8

Standpipe Systems

- Dry systems
  - Can only be fed by fire department pumpers
  - Could be found in unheated buildings
  - Are required by newer fire codes
    - Multiple risers must be interconnected
    - It takes time to force air out of the system

FIRE 207-PPT-4-2-9

Standpipe Systems

- Wet systems
  - Contain water at all times
  - May have a Class I rating or Class III rating, which requires that the system be able to deliver at least 250 gpm at 100 psi at the highest point according to NFPA 14
  - May have a Class II rating, which requires that the system be able to deliver 100 gpm for 30 minutes at 65 psi
  - If automatic or semiautomatic, require a minimum of one pre-connected water supply that is capable of supplying the standpipe system's demand for a minimum duration

FIRE 207-PPT-4-2-10

Standpipe Systems

- Wet systems
  - Require the use of public waterworks
    - Other sources are used under extenuating circumstances
      - Pressure pumps boost pressure in the primary water supply
      - Gravity tanks can be used in one- and two-story buildings
      - Pressure tanks are found in smaller systems like residential sprinklers
    - Firefighters must know the water supply sources for their area

FIRE 207-PPT-4-2-11

Standpipe Systems

- Wet systems
  - Could have multiple systems within the primary system
    - Risers could be separate or connected
    - FDCs depend on whether or not the risers are connected
      - On separate systems: one intake for each riser
      - On interconnected multiple systems: two or more intakes

FIRE 207-PPT-4-2-12

Standpipe Systems

- Wet systems
  - Must have a cut off or control valve between the system and the water source
    - Post indicator valves are usually found on industrial and warehouse properties
    - Gate valves or outside stem-and-yoke valves are installed in apartment buildings, office buildings, and stores
    - There may be multiple valves that divide the system into controlled areas

FIRE 207-PPT-4-2-13

Fire Department Connections

- Are required on all Class I and III systems
- Serve as the only water supply on manual standpipe systems
- Serve as an auxiliary water supply on automatic and semiautomatic standpipe systems
- Have one $2^1/_2$ inch inlet for each 250 gpm of flow
- Are sometimes required to connect to a LDH

FIRE 207-PPT-4-2-14

Fire Department Connections

- Can be one of four types
  - Wall-mounted siamese
  - Free-standing siamese
  - Free-standing multiple siamese
  - Wall-mounted concealed siamese

FIRE 207-PPT-4-2-15

Fire Department Connections

- Must be checked to ensure all parts are working
  - Valves
  - Fire pump
  - Pumper and connection
  - Clapper valves if any
  - Adapters if using LDH

FIRE 207-PPT-4-2-16

Fire Department Connections

- Could be damaged
  - Water can be supplied to the system via the first floor outlet
  - Remove all other connections on the first floor before doing so
- Should be easily accessible
  - Pumper should be within 100 feet
  - Hose should be laid from an adequate water source to the building

FIRE 207-PPT-4-2-17

Fire Attack from Standpipe Systems

- Firefighters are to check valves while ascending or descending stairwells
  - Check all valves on standpipes on lower floors to ensure they are in working order and closed
- Firefighters are to carry their equipment to the fire floor
  - Hoselines
  - Tools

FIRE 207-PPT-4-2-18

Entering the Building Safely

- Safety
  - Wear full PPE
  - Work in teams of two
  - Have radios
- Checking above the fire
  - Use hoselines
  - Check for exposure
    - Support search and rescue efforts
    - Support forcible entry and evacuation

FIRE 207-PPT-4-2-19

Entering the Building Safely

- Checking above the fire
  - Be aware of leaping, lapping or frogging
- Checking below the fire
  - Use hoselines
  - Consider property conservation early in the incident

FIRE 207-PPT-4-2-20

Entering the Building Safely

- Use of elevators
  - Check your jurisdictional SOPs/SOGs
  - Use elevators only if it is safe to do so
  - Do not take an elevator to the fire floor or above the fire
    - Stop two floors below
    - All personnel in PPE before entering the elevator
  - Know where the controls are

FIRE 207-PPT-4-2-21

Beginning Attack Operations

- Attach hoseline to the standpipe in the enclosed stairwell on the floor below the fire
  - Remove houselines intended for occupant use
  - Pull hoselines to the fire floor before they are charged
    - If the corridor is involved charge the line, then advance
    - If smoke is present advance the hose, then charge it

FIRE 207-PPT-4-2-22

Beginning Attack Operations

- Additional hoselines can be advanced up the stairs from lower floors if the floor below the fire is untenable
- If the fire is some distance down the hallway, the hookup can be made on the fire floor ONLY IF THE FIRE IS KNOWN TO BE CONTAINED

FIRE 207-PPT-4-2-23

Beginning Attack Operations

- Be aware that stairwells will be used for occupant egress
  - Be aware of the amount of smoke entering the stairwells
  - Consider sheltering in place if possible
- Consider a $2^1/_2$ inch hoseline if the fire has made considerable headway

FIRE 207-PPT-4-2-24

Beginning Attack Operations

- Do not become overconfident or complacent when working in fire-resistant structures
- Use whatever means are necessary to handle the fire

FIRE 207-PPT-4-2-25

Other Uses for Standpipe Systems

- Fire attack in adjoining buildings
- Exposure protection
- Use of gravity tanks
  - Use this as a last resort

FIRE 207-PPT-4-2-26

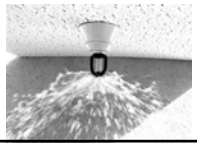
Automatic Sprinkler Systems

- Can sometimes apply water more effectively than a fire department using hoselines
- Cover a large area using piping and branches with sprinkler heads at strategic locations
  - One sprinkler head covers 100ft^2
  - Fire control with sprinklers can only be accomplished if there is enough pressure in the system

FIRE 207-PPT-4-2-27

Automatic Sprinkler Systems

- Can be classified into four types: wet-pipe, dry-pipe, preaction, and deluge
  - Wet-pipe
    - Filled with water
    - Activated when sufficient heat is generated to open the sprinkler head
    - Simplest of the four types
    - Cannot be used in unheated buildings



FIRE 207-PPT-4-2-28

Automatic Sprinkler Systems

- Dry-pipe
  - Can be used in unheated buildings
  - Contains water when the control valve is activated
    - The sprinkler heads open up and release compressed air
    - The compressed air release trips the control valve which releases the water into the system
- Preaction Systems
  - Dry-pipe systems with the addition of air exhausters and a fire detection system
    - When the detection system is activated it releases compressed air and lets water flow through the system

FIRE 207-PPT-4-2-29

Automatic Sprinkler Systems

- Deluge Systems
  - Designed to deliver large amounts of water quickly
  - Active at all times, but controlled by a fire detection system that releases a control valve
  - Installed in high hazard areas

FIRE 207-PPT-4-2-30

Setting up Water Supply for Sprinkler Systems

- Perform in accordance with jurisdictional SOPs/SOGs
  - Wait for signal from the IC
  - Begin pumping at 150 psi
  - Lay additional hoselines if necessary

FIRE 207-PPT-4-2-31

Setting up Water Supply for Sprinkler Systems

- Accomplish with offensive attack
- Use for exposure protection
  - Hook to FDCs of exposed buildings
  - Begin pumping only when the sprinkler system activates
- Do not shut down until the IC gives the order to do so
  - Leave one firefighter at the control valve
  - Additional crews should check for final extinguishment

FIRE 207-PPT-4-2-32

Other Protection Systems

- Usually operate in the same way as sprinkler systems but deliver fog, spray, foam, or another extinguishing agent
- Vary with types of buildings and their uses
- Could require manual operation for starting
  - May use a pump to operate
  - May need an additional water supply
- Must stay in operation until final extinguishment signaled by the IC

FIRE 207-PPT-4-2-33

Student Performance Objective

- Given information from discussion, handouts, reading materials, and lecture the student will be able to identify, utilize, and supply standpipe systems for initial attack to a written test accuracy of 70%.

FIRE 207-PPT-4-2-34

Review

- Standpipe Systems
- Fire Department Connections
- Fire Attack from Standpipe Systems
- Entering the Building
- Beginning Attack Operations
- Other Uses for Standpipe Systems
- Automatic Sprinkler Systems
- Setting Up Water Supply for Sprinkler Systems
- Other Protection Systems

FIRE 207-PPT-4-2-35

Engine Company Fireground Operations

Lesson 4-3
Overhaul

Maryland Fire and Rescue Institute

Student Performance Objective

- Given information from discussion, handouts, reading materials, and lecture the student will identify components of overhaul and overhaul operations to a written test accuracy of 70%.

FIRE 207-PPT-4-3-1

Overview

- Overhaul
- Personnel
- Overhaul Operations

FIRE 207-PPT-4-3-2

Overhaul

- Overhaul is the systematic examination of the aftermath of a fire scene to determine whether there is any possibility of reignition or rekindle
- Overhaul should only be conducted after a building inspection to determine structural integrity

FIRE 207-PPT-4-3-3

Overhaul

- Conduct in full PPE and SCBA
- Search for hidden fires
- Keep property conservation in mind

FIRE 207-PPT-4-3-4

Personnel

- May need a rest period before beginning overhaul operations
- May be reassigned from a back-up line or exposure building to conduct overhaul operations
- Will be supervised within the structure during overhaul operations
- Should not be allowed to enter the building unless directed to by the supervisor or IC

FIRE 207-PPT-4-3-5

Personnel

- Personnel from truck companies typically conduct overhaul operations
  - Engine companies will only perform the overhaul duties when truck companies are unavailable
  - Engine company firefighters must know their tasks to accomplish

FIRE 207-PPT-4-3-6

Overhaul Operations

- Reduce all handlines to $1^1/_2$ or $1^3/_4$ inch
  - Allows less water to flow
  - Allows for easier handling
- Begin looking for extension close to the area where firefighting operations ended
  - Look for evidence of fire
  - Listen for crackling or snapping sounds
  - Feel for heat

FIRE 207-PPT-4-3-7

Overhaul Operations

- Use thermal imaging cameras to assist in finding hidden fire
- Check the floor above and below the fire to determine whether or not fire has penetrated the ceiling or floor
- Check all vertical shafts and channels to search for hidden fire
- Check all cabinets or compartments to determine whether or not fire has penetrated the walls

FIRE 207-PPT-4-3-8

Overhaul Operations

- Check and feel all door and window casings for fire extension
- Remove excess water to reduce the weight of floors
  - Push water into vertical opening
  - Use portable pumps to remove water
- Cause as little damage as possible

FIRE 207-PPT-4-3-9

Student Performance Objective

- Given information from discussion, handouts, reading materials, and lecture the student will identify components of overhaul and overhaul operations to a written test accuracy of 70%.

FIRE 207-PPT-4-3-10

Overview

- Overhaul
- Personnel
- Overhaul Operations

FIRE 207-PPT-4-3-11