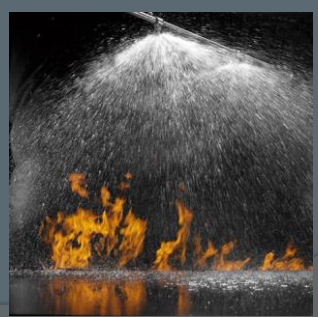


ENGINE COMPANY OPERATIONS CLASS 3



1

Sprinklers and Standpipes



2

SPRINKLER SYSTEMS

- Designed to automatically distribute water.
- Most sprinklers detect heat and begin to apply water directly over the heat source.
- NFPA publishes standards for installation, inspection and maintenance of sprinkler systems.
- Originally designed to protect property.
- Residential sprinklers combined with effective smoke detection systems allows maximum life safety in homes.



3

VALUE of SPRINKLERS

- Safety to Life
- Protection of Property
- Business Interruption
- Water Damage
- Area Economics
- Effectiveness of the System




4

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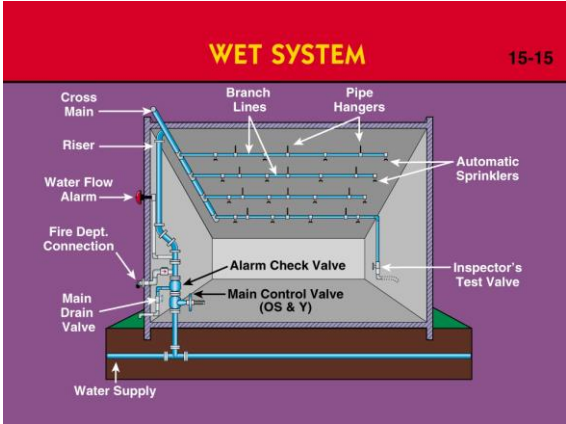
TYPES of AUTOMATIC SPRINKLER SYSTEMS

- Wet Pipe
- Dry Pipe
- Pre-Action
- Deluge
- Residential – Plastic Pipe

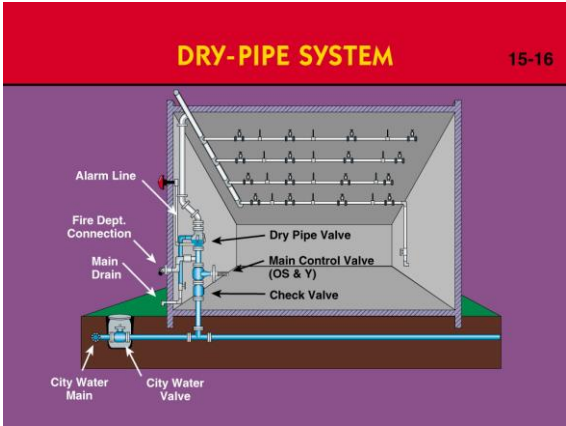


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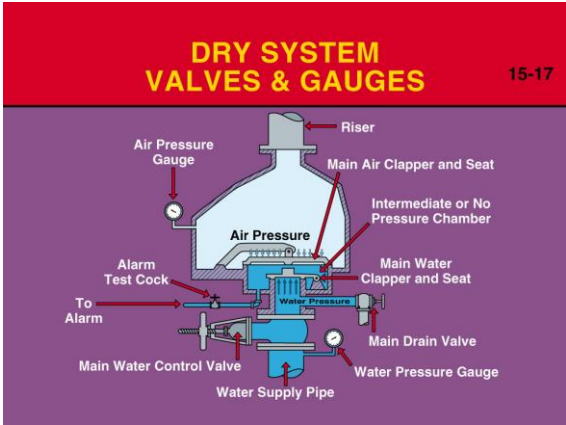
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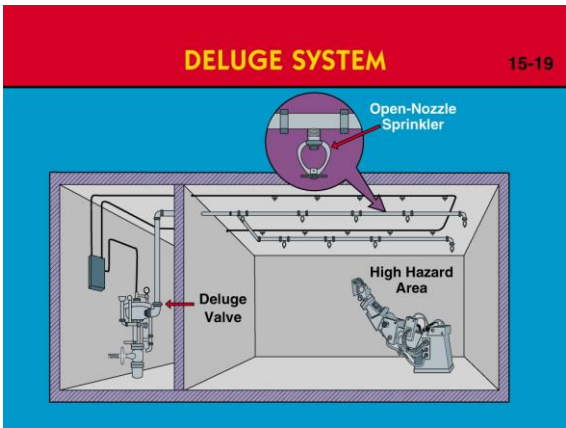
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9

Complete vs. Partial Coverage

- Completely Sprinklered Buildings
- Entire Structure has Sprinkler Protection
- Partially Sprinklered Buildings may have only a portion of the Structure Sprinklered
- For Example?
 - Basement
 - Hallways
 - Garage
 - Loading Docks




10



11

SOURCES of WATER SUPPLY


- City Main
- F. D. Connections (FDC)
- Fire Pump Suction Tank
- Pressure Tank
- Gravity Tank



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Water Supply

- One of the 1st Priorities should be to Supply the Sprinkler System
- Maintain 150 PSI
 - (using two lengths from a dedicated Engine)
- Additional Heads Discharging & Upper Floor Fires may Require Additional Pressure



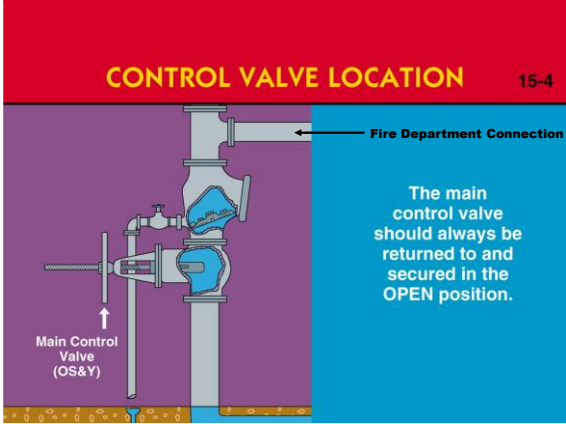
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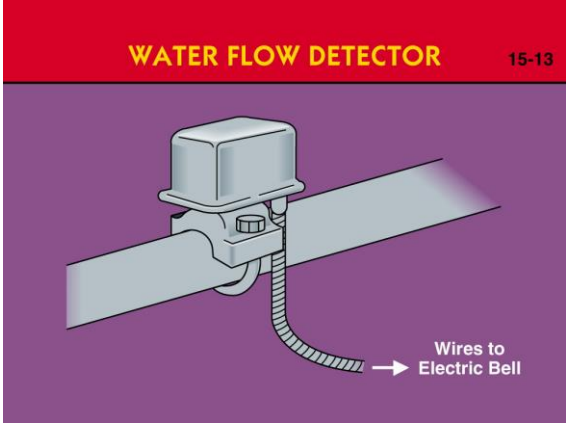


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The main control valve should always be returned to and secured in the OPEN position.

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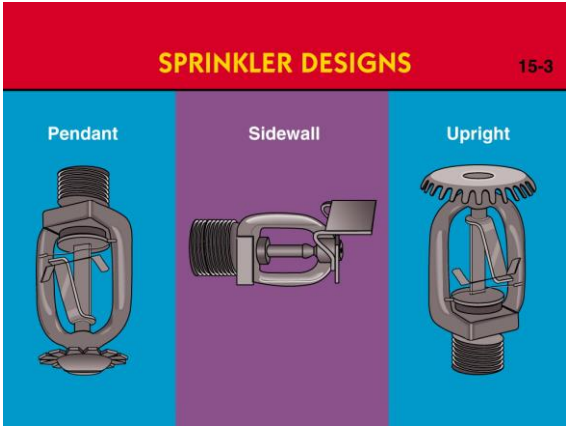
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SPRINKLER HEAD DESIGN AND OPERATION

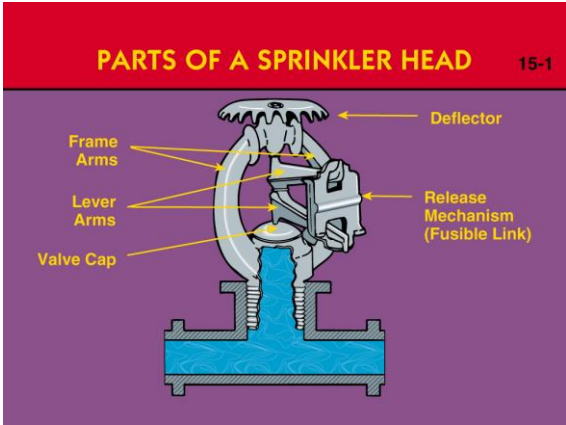
- Key component of the system.
- Heat sensitive parts detect heat and apply water to fire.
- Sprinkler heads come in many designs.
- Operation begins when fusible element reaches it's fusing point.
- Three types of fusing elements:
 - Fusible link
 - Bulb filled
 - Chemical pellet



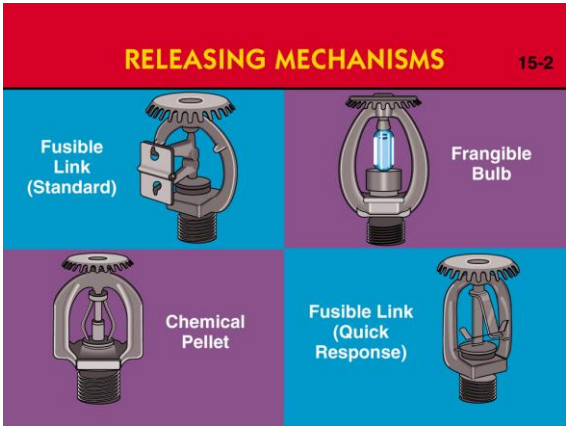
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21


Upright – Pendant – Wall Heads



22

Temperature Ratings / Colors

● Ordinary	135 – 175	Uncolored
● Intermediate	175 – 225	White
● High	250 – 300	Blue
● Extra High	325 – 375	Red
● Very Extra High	400-475	Green
● Ultra High	500 – 575	Orange




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Sprinkler System at Residential Structures



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Supplying a Sprinkler System

Note clapper valve

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Sprinkler Operations


- Siamese (Green)
- Pump Pressure (150 psi)
- OS & Y Valve
- Replace Heads?
- HIGH CO Levels




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Sprinkler System Operations

- Fire department connection **green**
- Supply as soon as possible
- 2 1/2" hose minimum
- Supply system with **150 psi** to start
- Know what areas the FDC supplies
- (FDC – Fire Department Connection)




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Sprinkler System Operations


- Heavy smoke conditions, high CO
- Use discharge that has flow meter
- Sprinkler heads discharge approximately 25 gpm
- Shut down ??
- Firefighter at OS & Y valve with radio



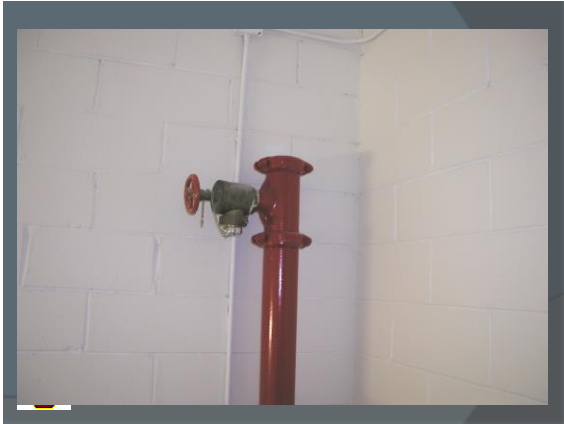
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SPRINKLER SYSTEMS REVIEW

- Types of systems
- Water Supply
- FDC
- Operating Pressure
- Restoration of System
- Wet/Dry/ Deluge/ Pre-Action
- Private/Public/Gravity Tank/Fire Pump
- Location/# of Lines
- 150 psi/ Flow meter
- Correct Head/ Turn Water On?



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Supplying Standpipe Systems



- Siamese connections
- Floor outlets
- Color coded
- Size of supply line
- 2 siameses
- 2 water sources
- 1 Pumper per line



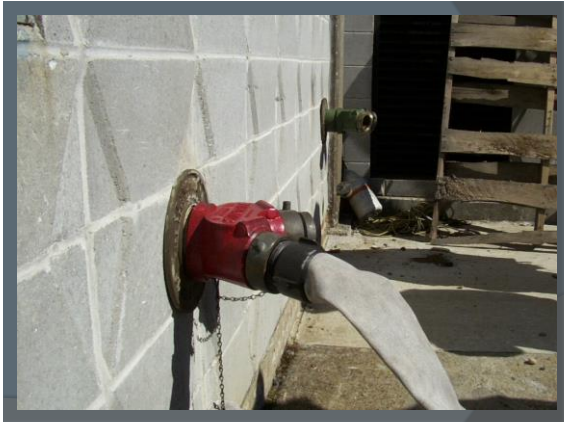

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Supplying Standpipe Systems

- Standpipe and Sprinkler systems
- Supply which 1st ?
- Problems with siamese
- Proper pressures
 - 100psi + 5 psi/floor
 - Know type of nozzle
 - 2 1/2" hose



33



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Supplying a Standpipe System


- 3" Hose is Ideal
- 2 1/2" acceptable
- Positive Supply of Water
- Two Different Water Sources
- 1st floor Outlet

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Supplying a Standpipe System

- Engine Discharge Pressure
- Use 2 - 50' Lengths of 3" Hose
 - Floors 1-10 150 psi
 - Upper Floors 11 -20 200 psi



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Supplying a Standpipe System

- If Siamese Swivel is Frozen, Twist the Supply Line 5-6 Turns to the left then thread the Supply Line into the Siamese by turning to the right.



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Supplying via 1st Floor Outlet

- Supply Line brought to 1st Floor Outlet
- Remove Cap & PRD
- Flush Outlet
- Attach Double Female
- Attach Supply Line
- Open Outlet Fully
- Maintain Proper Pressure




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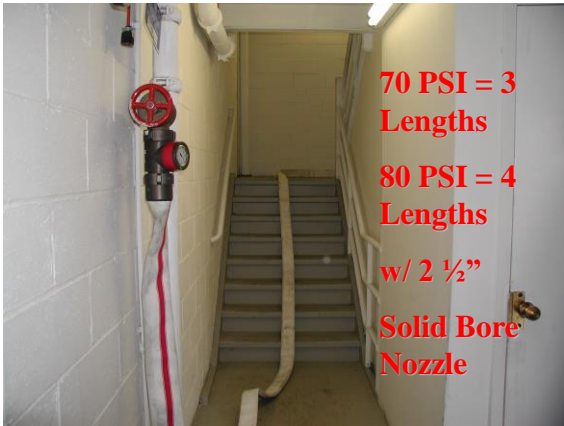
In-Line Pressure Gauge

49



Hooking Up

50



**70 PSI = 3
Lengths**
**80 PSI = 4
Lengths**
w/ 2 1/2"
**Solid Bore
Nozzle**

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Standpipe Systems

- Hose outlets
 - Size
 - "House lines"
 - Fire Dept. hose



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"The Nozzle"

- Solid Bore vs. Vari-Stream
 - Nozzle Pressure
- Hose diameter vs. friction loss
- Number of lengths
- Steam conversion
- System Design
 - Roof tank? Ability to augment?



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The Standpipe Stretch

- 1st hose line from floor below fire
- **NEVER use outlet on fire floor !!**
- Make all connections on floor below in hallway outside the stairs in fresh air
- FF at every turn
- Doors Chocked



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The Standpipe Stretch

- Flush system
- Remove any pressure reducing device
- Attach pressure gauge
- Connect hose
- Start water



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The Standpipe Stretch


- **Communication !!**
- Check pressure at gauge with water flowing
- Rule of thumb
 - 3 lengths, 70 psi
 - 4 lengths, 80 psi

60

Additional Hose Lines


- May be from 2 or more floors below, consider number of lengths needed
- Stairway configurations can create problems (Scissor Stairs – A or B Stairs)
 - Attack Stair designated?
- Core Construction – Wrap Around



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Common Problems

- No water at outlet ?
- Control/section valves
- Low pressure ?
 - Valve not open completely
 - Is Pressure reducer removed ?
 - Break in pipe below outlet ?
 - ***KINKS !!!***




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Additional Considerations

- Additional air cylinders
- EMS staging near fire floor
- Staging additional resources near fire floor
- Building fire pumps – engineer/maintenance personnel
- Elevator Operations



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Foam




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Foam Operations Objectives


- Terms
- How Foam works
- Types
- Do we have enough?
- Foam Equipment



66

Foam Operations


- DO NOT START a foam operation until you have enough on hand.
 - Fire will not go out and you will waste foam
- Until foam arrives? Protect exposures and evacuate.
- If at a facility, ask on site personnel.



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What is Foam?



- It is an aggregate of air filled bubbles, with a lower density than flammable liquids.
 - Foam Floats!!
- Makes a cohesive blanket
 - Keeps in vapors
- Resistant to heat, tolerant of fuel
 - Will not immediately break down



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Firefighting Foam

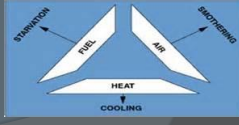
- Foam Concentrate + Water =
 - Foam Solution
- Foam Solution + Mechanical Agitation + Air =
 - Finished Firefighting Foam


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How Foam Works

- Smothers
 - Prevents release of vapors
- Separates
 - Creates a barrier between fuel and fire
- Cools
 - Lowers fuel temperature




The diagram shows a fire triangle with 'FUEL' at the bottom, 'HEAT' on the left, and 'AIR' on the right. A foam layer is shown covering the fuel. Arrows labeled 'SMOTHERING' point to the foam covering the fuel. An arrow labeled 'COOLING' points to the foam layer. An arrow labeled 'SEPARATION' points to the foam layer separating the fuel from the heat and air.



70

Limitations


- Foam is 94% to 97% water
 - Do not use on
 - Electrical fires
 - Three dimensional fires
 - Pressurized gases
 - Combustible metals




71

Types of Foam

- Protein Foams
- High Expansion
- Aqueous Film Forming Foam
 - AFFF
- Alcohol Resistant Foam
 - ARFFF




A white foam canister with green and black text. The text includes 'AFFF', '3', and '6'.



72

Foam

- Most Firefighting Foam Concentrate
 - Can be used with al nozzles
 - Can be premixed
 - Has good low temperature viscosity
- May be either directly applied on fuel surface, applied indirectly, or used with a subsurface injection Siamese.




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Foam Delivery

- Inline or Bypass Eductors
 - Portable system
- Around the Pump Eductor
 - Mounted on apparatus
- Compressed Air Foam
 - Class A Foam



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Foam Operations

- To be effective, Foam concentrate must be matched to the burning product.
- AFFF for Hydrocarbons
- ARFFF for Polar Solvents




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Foam Operations


- Foam must be proportioned with water and aerated with air to be used effectively
- Most foams are designed to be mixed at either a 3% or a 6% mixture with water.
 - Ex: For a 100 gallon foam solution at 3%, you need 97 gallons of water, 3 gallons of foam concentrate.



76

How much foam do we need?


- Whats burning?
 - Polar solvents
 - .16 GPM per SQ FT.
 - Hydrocarbons
 - .10 GPM per SQ FT
- As Per NFPA 11 Foam must be applied for 15 minutes.



77

Ugh Math


- We have a 100' x 10' area of Gasoline burning = 1000 sq feet
 - $1000 \times .1 = 100$ Gallon of foam/ Minute
 - 3% of 100 = 3 Gallons of foam concentrate
- 3 gallons of foam concentrate for 15 Minutes = 45 Gallons
 - 45 Gallons of Foam concentrate on hand before starting out Foam Operation



78

Field Foam Calculations


- Hydrocarbons
 - Area / 20
 - 1000 sq ft/ 20 = 50 gallons concentrate
- Polar Solvents
 - Area/5
 - 1000 sq ft/5 = 200 gallons foam concentrate



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How much water will we need?


- 100 gallons of foam/ Minute for 15 minutes
 - Foam solution is 3% foam. 97% water
- 100 GPM x .97 = 97 GPM
 - 97 x 15 = 1455 Gallons
- So to start our operation we need 1455 gallons of water, and 45 Gallons of foam on hand to start.



80



Foam Application

- Roll On
 - Apply foam in front of you allow it to roll over the fire
- Bank Down
 - Bank foam off an object, allow it to run down over fire
- Rainfall
 - Open nozzle in the air, make it rain foam over fire





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Roll On



82

Bank Down



83

Rainfall



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Foam Application Donts

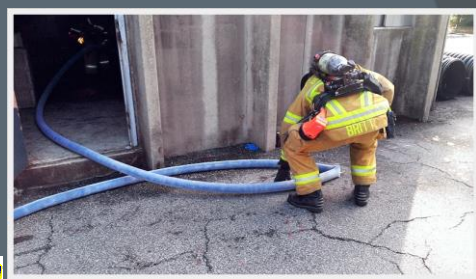
- Don't plunge your stream into foam blanket
- Don't walk in the liquid
- Don't turn your back on the flammable liquid



85

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Water Loss



86

86

Water Loss

- Serious problem which all members should try and prevent
- Most common problems
 - Kinks
 - Burst Length
 - Short Stretch



87

87

Kinks

- Can cause severe water loss
- Easiest problem to correct
- May not notice due to automatic nozzles
- Who may notice?
- Ecc watching flow meter and listening to portable radio transmissions



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Kinks

Table 3. Automatic Nozzle

KINK(S)	PDP	GPM		REDUCTION	REACH
		NP	NP		
No kink	150	150	110	---	---
1-90°	150	120	115	20%	NSC*
1-135°	150	105	105	30%	NSC
1-180°	150	75	100	50%	POOR
2-90°	150	115	115	23%	NSC
2-135°	150	100	110	33%	NSC
2-180°	150	30	90	80%	POOR

* no significant change



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Kinks



- Who is responsible for eliminating kinks?
- EVERYONE
- Kinks can cause reduced water flow which will compromise safety for everyone
- Kinks should be fixed as they are found
- Do Not increase hose pressure to correct kinks



90

Burst length

- What is a burst length?
 - When it reduces water flow enough to severely effect fire fighting capabilities
- Requires coordination, communication and time to correct





91

91

Urgent transmission

- Any member who notices burst length should transmit a "Urgent", notifying IC.
- ECC may again notice burst first, Officer reports little or no water, and flowmeter is showing increased GPM flow, increase in engine RPMs
- Once Urgent has been transmitted, officer should immediately take action to confine the fire, or move nozzle team to a safe area, until situation is resolved




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Burst length

- Communication is key
- After nozzle team is in safe area, or fire is confined, officer should send a member to replace the length or communicate with engine replacing length
- Engines should carry a rolled up 1 ¾ and 2 ½ hose for use in replacing burst lengths




93

93

Replacing length


- Locate the burst length
- Lay out new length next to burst one
- Contact engine officer to ensure
 - Nozzle team in safe area
 - Or fire is confined
- After engine officer approves, have handline shut down and replace length



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Short Stretch



- May not seem like a water loss problem, but it is a delay in getting water on the fire.
- Ensure members are in a safe area, or confine the fire.
- Notify IC that you have short stretched
 - Important to put over the radio, lets other units know of the delay



95

Adding a length


- If water shutdown is not required because you are using shutoff, have a member bring a length of hose and a nozzle to end of line
- Add length
- Have member ensure shutoff remains open

96

Adding a length

- If water shutdown is required
- Determine if hose will be added at engine or at end of line
 - May be easier at engine, but then entire stretch must be moved in
 - Added at nozzle or midway may be a bit more complicated, but will be easier on the stretch.




97

97

Adding a length

- Flake out hose in area to be added
- When officer is ready, shut down line, and add length.
- After hose is charged, check for kinks
- Assist in moving line into position




98

98

Water Loss Conclusion

- Can cause a significant impact on the operation
- Everyone is responsible to prevent a water loss
- Any Questions?
- Thank you



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