

Fire Science



Fire Tetrahedron

- Heat
- Oxygen
- Chemical chain reaction
- Fuel



Priorities

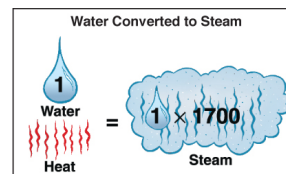
- Life Safety
- Incident Stabilization
- Property Conservation



Extinguishing agents

Why is water an extinguishing agent that is commonly used by the fire service?

Firefighters need to understand the basic properties of steam.



Complete vaporization requires boiling temperatures be maintained

(Cont.)

16-6



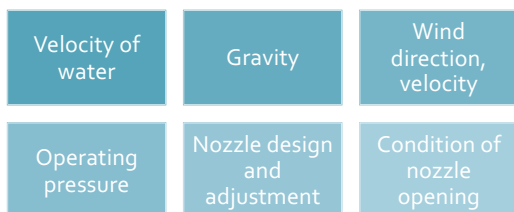
- What are the extinguishing properties of water?

16-7

Explain fire stream patterns and their possible limiting factors.

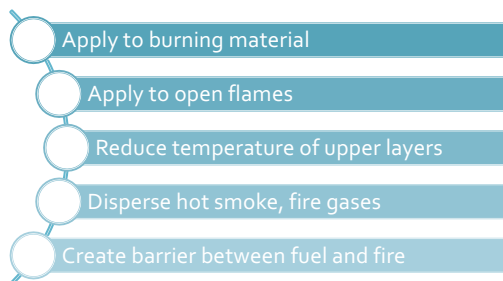
16-8

Several factors affect a stream of water or extinguishing agent from a nozzle.



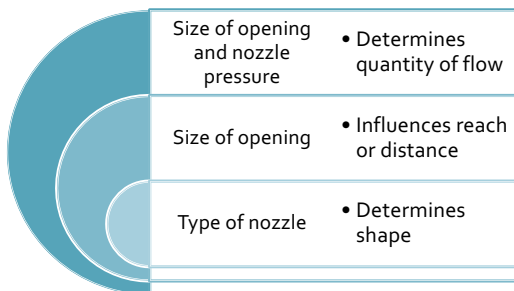
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Fire streams are used to accomplish several goals.



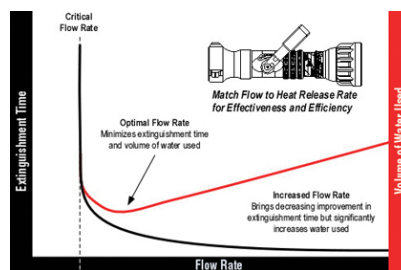
16-10

The type of nozzle used on a hose will have an effect on the fire stream.

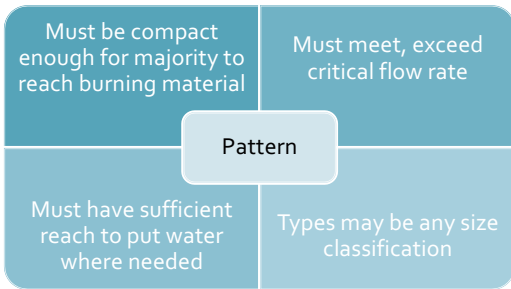


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The volume of water discharged is determined by nozzle design and water pressure.



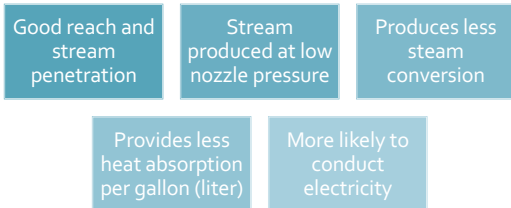
Fire stream type is the pattern or shape of the stream as it leaves the nozzle.



Several components are required for a fire stream to be effective.

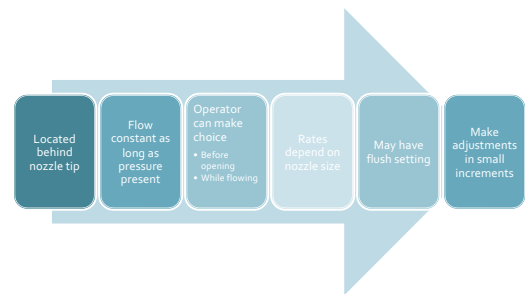


Solid stream characteristics can be described by several concepts.



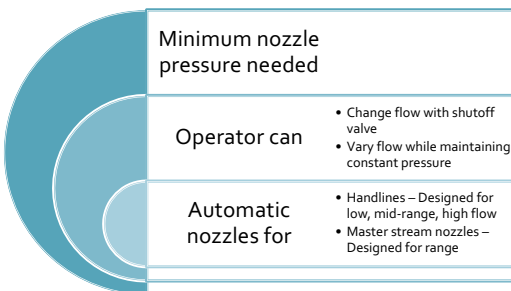
16-15

Manually adjustable fog nozzles can allow rate of discharge changes.



16-16

Constant-pressure fog nozzles automatically vary flow rate to maintain constant pressure.



16-17

There are several steps to follow for general nozzle care.



16-18

Firefighting Tactics

1st Engine Tactics

1. Locate Fire
2. Confine Fire
3. Extinguish Fire



Non fire direct tactics

- Ladders
- Overhaul
- Ventilation
- Entry – Forcible Entry
- Rescue
- Salvage
- Utilities
- Scene lighting
- Provide Electricity through generators
- Setting up master streams for defensive operations



FIRE COMPANY TACTICS

Second engine

1. Water supply
 - 1st line in place first then worry about a backup line
 - 2nd attack line – Same size line or larger
2. Protects means of egress
 - Stairs
 - Door where the first line entered
3. Confinement (prevents extension)
 - Protects exposures
4. Assists in extinguishment
5. Communication

ENGINE COMPANY TACTICS

- Water Supply
- Locate
- Confine
- Extinguish
- 3 Incident Priorities?

Water Supply

- Always secure a continuous water supply when responding to a fire



- Engine Company – What do you see?



Quantity of Line

- Enough line at any entrance to ensure advance through the fire area
- Private dwellings usually 10 to 15 meters
- Large area buildings require sound judgment/sometimes difficult to estimate what's needed through the fire area
- FF's stretching line, carry enough to drop point to flake out
- At every entrance to a fire area the line should be flaked out, charged, bled and manned ready for advance

FIREFIGHTING TEAM

- Fire fighting team
 - Company Officer-team leader
 - Engineer-responsible for safe operation of the apparatus to and from the scene
 - Delivers water to the hose lines
 - Firefighters - responsible deploying the hoseline, tool use, and maintaining accountability

Engine Company Operations at the Door

- Make sure you have sufficient amount of hose pulled and flaked out
- Have Water coming as soon as possible(reflex time)
- Check the door for heat
- Bleed Line
- Know operation of Fog Nozzle
 - Set as straight stream
 - Give engineer enough time to adjust your pressure
- **GO ON AIR (Check your Partner!)**

FIRE ATTACK: THE FIRST LINE

NOZZLEMAN

- Be able to turn nozzle from side to side, hit ceilings, sweep floors etc.
- Hose can be held tight under the armpit.



ADVANCING

- Be sure to check that other members are ready to advance.
- Never move into fire area alone.
- Keep the advance moving unless severe conditions/back out.
- Operate the line to cover your retreat.

BEYOND THE PRE-CONNECT

- Most of our work (structure fires) is safely and successfully handled with one 1-3/4" Pre-Connect
- 2-1/2" Hand Line (Big Line)
- Deck Gun
- Monitor (Ground Master Stream)

FIRE ATTACK: THE FIRST LINE

THE 2 1/2 LINE

- Based on arrival conditions.
- Building types
- Exposure protections



- A- advance fire on arrival.
- D- defensive operations.
- U- unable to determine fire area.
- L- large uncompartemented area.
- T- tons of water needed.
- S- standpipe operations.

DEFENSIVE OPERATIONS

Exterior attack

- used when interior attack is unadvisable due to peril of collapse or untenable conditions
- not enough water



Locate the Fire

- "Putting the proper size hoseline at the required place in the least possible time with the most efficient use of personnel is the job of the engine company." Chief John Norman
- Put the fire out and everything gets better
- Once the location of the fire is known, the attack line should cover the following priorities
 - 1) Intervene between the fire and victims
 - 2) Protect the Stairs (Why?)
 - 3) Protect rescuers
 - 4) Protect interior exposures (Cut the fire off)

Methods of Fire Attack

- Direct Attack
- Indirect Attack

Direct Attack

- For use on incipient fires.
- Solid or straight stream directed at the base of the fire.
- Steam production minimized.
- Thermal balance maintained.

Indirect Attack

- When firefighters cannot enter due to intense heat conditions
- Once fire darkened down & space ventilated, hoseline can be advanced

SMOKE

- Smoke is a fuel
 - Can transition into
 - Flashover [Video](#)
 - Rollover [Video](#)
 - Or Smoke explosion at any time (backdraft)

Fires in Upper Levels

- In standpipe operations, make hose connections/use hose cabinet on floor below the fire floor and flake hose to floor above fire floor. (based on a safe stairwell tower.)
 - Why do we hook up the floor below?
 - What is the distance from the cabinet to the stair well?
 - Why is this so important?
 - Emergency Egress – knowledge of building layouts

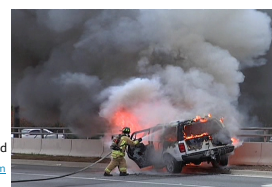
GENERAL TACTICS FOR HIGH-RISE FIRES

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Vehicle Fires

- Always be aware of Scene Safety
 - Traffic, Traffic
 - Smoke and fire
 - Struts
 - Hazmat
 - Meth Lab
 - Compressed Natural Gas (CNG)
 - Delivery trucks w/ Hazmats on board
 - Class D metals - [Car Fire w/ magnesium](#)
 - High voltage headlights
 - High voltage systems from hybrids
 - Tires
 - SRS – supplemental restraint systems (airbags)
 - [Airbags](#) [Airbags](#) [Airbags](#)



Vehicle Fires

- 1st Priority is to confine the fire to the vehicle
 - May mean protecting exposures 1st
 - Calling in additional resources
- Approach from up hill and up wind (maintain safe distance, utilize the reach of your hose stream)
- Position the hoseline between the burning vehicle and any exposures
- Use a straight stream at a distance to start cooling the vehicle at first.
- As you close on the car sweep your hose stream underneath the vehicle to extinguish any flammable liquids that may be leaking

Vehicle Fires

- Approach vehicle fire from a 45 degree angle
 - the front corner or rear corner with a narrow to wide fog
- Approach should be opposite the fire
 - Front end fire - approach from back
 - Rear end fire - approach from front
- As you close in on the vehicle adjust nozzle to a medium fog pattern
- Have Dry Chem/Light water on hand for fuel fire
 - Most rigs have a foam line if a large fuel spill exists

