DRAPER FIRE DEPARTMENT

Engine Company Operations

2024 Edition

Version 1.1

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-INTRODUCTION-

The content in the Draper Fire Department Engine Company Operations Manual reflects the dynamic changes that have occurred in both the professional fire service and the Draper Fire Department. Fire hose, nozzles, appliances, and apparatus have all undergone significant improvements over the last decade. As the landscape of our profession continues to change, being proficient in one's knowledge, skill and abilities are still the main priority.

The purpose of this manual is to provide both general and specific information concerning Engine Company operations. The Engine Company is the basic unit of service in this Department and its tactics and operations should be familiar to all members.

Engine Company firefighters must be familiar with the apparatus currently in service with the Department. Various makes and models exist and the differences between the apparatus include hose bed size and layout, location and number of discharge outlets, location and number of compartments, positioning of equipment such as ladders, master streams, and hydrant connections.

Response neighborhoods vary greatly from one section of the city to another, yet the basic duties of engine companies remain the same. The proper stretching and operating of hose lines is paramount to a successful fire ground operation and the tactics contained in this manual should be considered the standard operating procedure for all units in the city

This manual is based upon Engine Company staffing of an Officer, Engineer/ ADO, and one (1) Firefighter and or 2 Ambulance personnel.

-FORWARD-

From the beginning of Draper Fire Department in 2017, we have brought together members from multiple agencies across the state into one location. They were tasked with building our department from the ground up by incorporating policies, procedures, equipment, personnel, and much more. There have been many successes as this heavy task was undertaken by Chief Clint Smith and Deputy Chief Bart Vawdrey along with several other key members.

We have reached a part in the development of Draper Fire Department to create and establish standardization across our firefighting operations. Members of the 2024 training cadre were tasked with the modification of this manual to adapt it in an effort to meet the needs of Draper City residents. This manual will serve as the Standard Operation Guideline (SOG) manual for our department in which each member is responsible to understand and meet. These SOG's will elevate our service to a higher level, and standardize our operations across all platoons.

Firefighters are adaptable to changes that come across our industry and have been for many years. This is a manual that will stand for our Standard Operating Guidelines with the understanding that changes in operations, technology, or training may change the way Draper Fire Department operates. Revisions to this manual will be fully vetted and updated annually. Any new updates will be distributed to department personnel to ensure they have the most current and up to date information.

I look forward to seeing each of you put this information to work and excel at your skill set. You are each amazing individual's and Draper City is lucky to have you as a member of this department. Thank you for being a part of this great agency!

- Deputy Chief Steve Pearson

-CHIEF'S MESSAGE-

The creation of the engine and truck training manuals will serve as a critical tool in standardizing training across our department, ensuring that all personnel are equipped with the same foundational knowledge and operational procedures. By having clear, detailed manuals, every team member can consistently reference best practices for fire operation, maintenance, and emergency response protocols. This consistency not only minimizes errors but also enhances our ability to respond swiftly and effectively to residents' needs. With standardized training, we can ensure a higher level of preparedness, improving overall efficiency and reducing response times, ultimately leading to better outcomes for the community we serve.

Additionally, the manuals will support individual professional development by providing a structured framework for continuous learning, helping personnel increase their competency in both technical skills and emergency decision-making. This commitment to training aligns with our core values of teamwork, accountability, and community, fostering a culture of growth and ensuring that every team member is prepared to meet the challenges of their role while upholding the highest standards of professionalism.

Thank you to all those that have helped in the development of these manuals for their continued dedication to their craft, our department, and the community we serve. It is an honor to work with you and to be part of this noble profession.

- Chief Clint Smith

- ACKNOWLEDGMENTS -

Thank You to the following Organizations and/or Individuals for their contributions to this manual.

Sacramento Fire Department, Sacramento CA. (Sacramento Engine Company Handbook is the source for most of the information and formatting contained in this manual)

City of New York Fire Department, New York NY.

Firefighter Craftsmanship, Fort Collins CO.

Aaron Fields (Nozzle Forward), Seattle WA.

Andrew A Fredericks. New York NY

International Fire Service Training Association, Stillwater OK.

Alan V. Brunacini (Fire Command 2nd Edition), Phoenix AZ.

Elkhart Brass Manufacturing Company Inc, Elkhart IN.

Orem City Fire Department, Orem UT.

Sacramento County Fire Chiefs Association (High Rise Operations SOG), Sacramento CA.

The Northern Virginia Fire Operations Board Technical Writing Group. VA

Draper Fire Department Training Cadre-, Draper UT.

- TRAINING RESOURCES-

FIREFIGHTER ASSIGNMENTS

Minuteman Loading-
https://s3.amazonaws.com/tsresources.targetsolutions.com/60C4EF16- A783-1B4A-AA21-42A23EAE2687.pdf
FF Assignments- https://www.brasstackshardfacts.com/

STRETCHING THE HANDLINE

Estimating - https://firefightercraftsmanship.com/estimating-the-hose-stretch-on-residential fires/ Minuteman- https://www.youtube.com/watch?v=AKeWR7VgvgA&t=458s

Extending the hoseline- https://www.brasstackshardfacts.com/

FIRE ATTACK PRACTICES

Hose Advancement- https://www.youtube.com/watch?v=Y-W1zwR43b8- Engine Work- https://www.brasstackshardfacts.com/

Fire Attack- https://training.ulfirefightersafety.org/

STANDPIPE OPERATIONS

PRD/PRV'S- https://s3.amazonaws.com/tsresources.targetsolutions.com/30DEDBE8-5FB3-14EF-69B2-795B331FEE51.pdf
Denver Load Folding- https://www.youtube.com/watch?v=kmj9uwZQG2M&t=159s Denver Load Deployment- https://www.youtube.com/watch?v=xsub6Dz3inQ Standpipe Ops- https://www.brasstackshardfacts.com/

MASTER STREAM OPERATIONS

R.A.M.- https://www.brasstackshardfacts.com/

WILDLAND OPERATIONS

Wildland Suppression Tactics- https://s3.amazonaws.com/tsresources.targetsolutions.com/610DAF72-1781-5704-9876-9932AA667A95.pdf

Firefighter Assignments

1

Notes

- FIREFIGHTER ASSIGNMENTS-

At the very core of the fire service is the extinguishment of the fire. The Engine Company is responsible for accomplishing this. There is a basic fundamental principle in firefighting that "*Human life shall take precedence over all other concerns*." (John Norman Battalion Chief, FDNY 1991) Draper Fire Engine Companies can accomplish this by following two simple ideals. First, "The fire goes as the first line goes". It is a well-known fact that an unchecked fire potentially doubles in size every minute. Delayed or improperly placed lines by the first arriving engine can set into motion a sequence of events that become difficult to overcome or correct. This can have a devastating effect on the outcome of the fire. Second, "If you put out the fire, everything gets better". Simply put, "more lives are saved by properly placed and operated hose streams than by any other means." (Lt Andrew Fredericks FDNY) Deviating from this practice will cost lives. These convictions should always remain at the core of our engine company operations.

There are many elements of Engine Company operations that are essential to accomplishing our core belief, but none is more important than the performance of the Engine Firefighters themselves. A critical component is pre-assigned riding positions and basic assignments on the fire ground that are assigned by rank and designated by where the members sit on the apparatus. Arrival order for that company and the type of occupancy the company is responding to will affect the basic assignments. For this reason, the success of the engine company starts by defining each firefighter's responsibilities as determined by their specific riding position. While this concept may seem rudimentary, it takes time and training to develop this discipline within a crew.

Most Draper Fire Engine Company crew consists of 3-4 members. (Engine Company positions include: Engine Officer (A), Engineer (B), Nozzle (C), Back-up (D). These are the radio designations for each position. If a department member is calling a particular company, then the Officer will answer the radio for that company. (e.g., "Engine 22, Engine 23.") The Officer for Engine 23 would answer the radio. If one member needs to talk to a particular company member on that company, then that member is identified by their riding position and company identifier. (e.g.: "23 Charlie, 23 Delta". These pre-assigned, unique radio identifiers assist in eliminating confusion on the radio and add an element of accountability.

Each company member has an assigned set of responsibilities. These responsibilities, unique to each position, when performed properly, give the Engine Company the best possible chance of completing its mission. Failure to do so can have extremely negative effects on the entire process. For example, should the Back-Up Firefighter fail to check and chase kinks for the attack line, that line will be delayed in advancing because of the lack of water pressure.

ENGINE COMPANY OFFICER

The Engine Company Officer is the supervisor of the engine and crew. This position can be filled by either a Captain or qualified acting Fire Officer. The main duties of the Engine Officer while responding and operating at a structure fire include:

1. Directing the Engineer to the incident.
2. Determine the appropriate Strategy/tactics for the incident.
3. Based on staffing become a working or nonworking supervisor of the Engine Company.

TOOLS (*Photo 1-1*)

While the Company Officer's main duties will always be supervisory, these are the essential tools and equipment that assist them at the scene of a structure fire.

- Radio
- Flashlight
- Halligan Bar or tool of choice
- Thermal Imaging Camera (TIC)
- Any Incident specific tools (Keys, 4-gas, etc.)

Photo1-1: The tools of the Engine Company Officer

RESPONSIBILITIES

The Company Officer responsibilities at a structure fire can be broken into the three basic phases; responding to, on arrival, and suppression.

A. Responding to:

- Assisting the driver by giving directions to the incident.
- Locating a water source. The officer has several options for securing a water supply; lay-in wet, lay-in dry, reverse lay, or hand-jack. If unable to take their own supply line, the officer **Shall** notify the next incoming company to lay in a water supply.
- Monitor Radio channel for updated information.

Photo 1-2: The Officer needs to monitor the radio and MDT for updates.

B. On Arrival:

1st Due

- Transmit report on conditions as first arriving unit using DCFD Initial Size-up found on ***DCFD Tactical Worksheet***

- **Unit on scene**
- **Describe the building and what conditions seen,**
- **Declare side A**
- **Name incident _____**
- **Declare *Strategy:* Offensive, Defensive**
- **Declare *Mode*; Investigation, Fast-action, Command**)

Other considerations after Initial Size-up:

- **Working Fire Notifications if Needed**
- **Conduct or Assign 360**
- **Develop IAP "How we accomplish the Strategy"**
- **Ask for additional recourses if needed**
- **Assign Safety Officer**
- **Assign Support Officer if needed**

Photo 1-3: Members prepare to advance the initial hoseline through the front door.

The first-arriving engine Company Officer must determine which **Strategy (Offensive vs Defensive)** and **Mode (Investigation, Fast-Action, or Command)** to operate in. **Operational Strategies (Offensive vs. Defensive)**

OFFENSIVE OPERATIONS

Offensive operations are conducted where incident conditions will allow workers to make a fast, active fire attack inside the hazard zone. In fire situations, hand lines are extended into the fire area to support the primary search and to control the fire, while related offensive support (forcible entry, ventilation, and provision of access) is provided to clear the way for the attack. The offensive attack strategy is aggressive, and quickly moves into directly overpower and extinguish the fire from the inside. Offensive operations are our strategic mode of choice. Wherever and whenever conditions permit, we should extend a strong, well-supported interior attack that controls interior conditions, and directly protects our threatened citizens. We start the attack process an aggressive offensively oriented strategy, and quickly develop defensive actions when conditions dangerously limit an interior attack and we have no other option for an offensive attack.

DEFENSIVE OPERATIONS

Most incidents move through a set of fairly standard stages that begin small, and become larger and more severe. As the event goes on, conditions will reach a point where it is unsafe for workers to go inside the hazard area. In these cases, the IC must conduct defensive operations from outside the hot zone. During defensive fire operations, large exterior fire streams will be placed between the fire and the exposures to prevent fire extension. During active defensive operations, perimeter control becomes critical since firefighters should not enter the fire areas.

Command Modes (Investigation, Fast-Action, or Command)

Investigation (Nothing Showing) Mode

Usually, the first arriving officer will go with investigation mode while directly searching for information on current and forecasted conditions to form the basic incident action plan.

Fast-Action Mode

An active, dynamic problem is present upon the arrival of the first responder and requires immediate action to stabilize. This fast-action mode should be concluded rapidly with one of the following outcomes:

a. The situation is quickly stabilized (i.e. incident problem is solved) by fast, offensive action.
b. Command is transferred from the fast-action company officer IC to next arriving company officer or BC.
c. For whatever reason if the situation is not stabilized, the fast-action company officer IC moves to exterior (stationary) command position and is now in the command mode.

Command Mode

Because of the size/severity of the situation, the complexity of the occupancy, the hazards present, or the possibility of the basic incident problem expanding, some scenarios will demand early, strong, stationary, command from the very onset.

Once the first arriving Engine Company Officer determines the course of action (Strategy and Mode), they issue the initial orders and the crew performs them.

If lives appear threatened upon arrival and a second arriving company is not yet on the scene, life-saving operations must be immediately initiated. As previously stated a

rapid attack on the fire remains the best option for saving lives. Second and subsequent arriving companies base their operations on the initial size up taken by the first engine and perform specific tasks depending on their order of arrival and occupancy type.

Subsequent Arriving Engines

- Assume Command (If initial IC declared Fast-Action Mode)
- Stretch additional hose lines (per assignment)
- Additional Assignments as assigned

Additional Engine Truck or Other Assignments may include

Engine Company Assignments

- Water Supply
- Relay Water Supply
- Additional Attack Lines
- FDC
- RIT
- Exposure Protection
- Investigate alarm panel

Truck Company Assignments

- Ventilation
- Search / Rescue
- Forcible Entry/Egress
- Ladders
- Secondary Search
- Utilities
- Salvage
- Overhaul

Other Assignments

- Medical
- Support Officer
- Safety Officer
- PAR
- Rehab

C. Suppression

- Supervise and when needed help control the fire attack hoseline.
- Transmit progress reports (CAAN).
- Assist the Back-Up firefighter with force entry if needed.

Photo 1-4: The Officer backing up the Nozzle Firefighter.

If functioning as a working supervisor, prior to the attack line advancing into the fire area, the Company Officer takes a position as close as physically needed on the hoseline behind the Nozzle Firefighter. The Company Officer directs and assists the advancement of the attack line toward the fire. It is the Company Officer's responsibility to absorb as much nozzle reaction as possible. ***(Photo 1-4)***

During a hoseline advance the Officer must maintain the hoseline below the level of the operating nozzle, keep the line as straight as possible, and maintain a firm grip on the hoseline while exerting enough forward force on the hoseline to counter the nozzle reaction. If staffed the Tailboard firefighter will assume these and other working assignments of the Engine Company Officer.

In addition to backing up the Nozzle Firefighter when needed, the Company Officer is the eyes and ears of the attack team. They are constantly evaluating fire conditions as the fire attack line is advanced, and providing updates to the Incident Commander. The acronym **CAAN** is the accepted standard for providing updates to incoming companies or the established Incident Commander.

C **Conditions**-current fire conditions and progress
A **Actions-**current actions that the engine is taking
A **Air-**current lowest bottle pressure of team
N **Needs**-additional recourses, tactical support, etc.

ENGINEER / ADO (DRIVER)

The Engineer position may be filled by an Engineer or qualified Apparatus Driver Operator (ADO) that possess all DCFD required certifications, and is current with DCFD proficiency. (Annual Engineer Day attendance)

The Engineer must be thoroughly familiar with the engine apparatus, all the tools and equipment carried on board and the layout of the hose beds. Knowledge of the amount and size of hose carried and stretched at operations will assist the Engineer in determining the proper pressures required. The Engineer must control how many and what type streams and hose lines are supplied and should confer with and advise the officer when necessary.

Photo 1-5: The Engineer is responsible for maintaining the correct pump pressure during fire attack operations.

(Photo 1-5)

The Engineer must monitor the radio for instructions and information that may require action and be ready to assist members in distress if ordered by the IC.

TOOLS

- Radio
- Personal turnouts to include work gloves and helmet during pumping operations.

RESPONSIBILITIES

The primary responsibility of the Engineer is the safe delivery of the personnel, apparatus and equipment to a reported fire or emergency and the delivery of water to the operating firefighting force and:

1. Maintain the apparatus of his/her station in a constant state of readiness. This includes all backup and other fire apparatus, excluding Ambulances.
2. Effectively operate all apparatus to which they are assigned at any given time or place.
3. Must know how many hose lines, size, length, nozzles, and the flow rates of their apparatus. (DCFD hydraulic standard)

B. On Arrival:

On arrival the Engineer of the first arriving engine needs to make every attempt to provide the Company Officer with a sufficient view of the fire building. Generally, the first engine should leave the front of the building open for the Truck's aerial if needed. Other spotting considerations for the Engine Company include water supply needs, FDC connections, line placement, fire location and intensity. Second arriving engines should position so as not to block any apparatus movement on the fireground and be able to lay a supply line from the first-in engine to the hydrant. Third due engines and later-arriving engines should position their apparatus out of the way of the direct fire scene or consider taking a position in the alley behind the structure to provide additional lines more easily.

1st arriving Engine Company apparatus should be positioned as close as possible to the fire building to reduce the time, effort and number of lengths needed to connect to a water source. This tactic requires a coordinated effort between the Engineer, the Engine Company Officer, and the first arriving Truck Company for optimal placement.

1st Due-nothing showing and Alarms:

1. Park in a location that allows for easy access by ladder trucks.
2. Engineer/ADO should fully prepare his engine by completing all steps required to put the pump in service and supply water to hose.
3. No hydrant connection made until otherwise warranted by fire involvement.
4. Engineer will stay by the pump and monitor radio traffic for further assignments.

C. Suppression:

- Water supply.
- Pump Operations.
- Obverse the conditions of all the hoselines stretched.

The Engineer must recognize the need for and initiate supply line operations when required. When arriving other than first due, the Engineer must remain aware of water supply needs of units already on the scene.

Tactics that the Engineer must be capable of performing include:

- Forward Lay operations (fig. 1-1)
- Reverse Lay operations (fig. 1-2)
- FDC Supply

Fig. 1-1 (IFSTA)

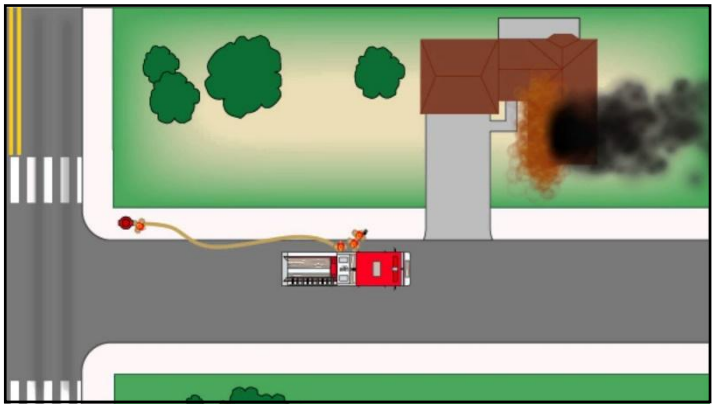
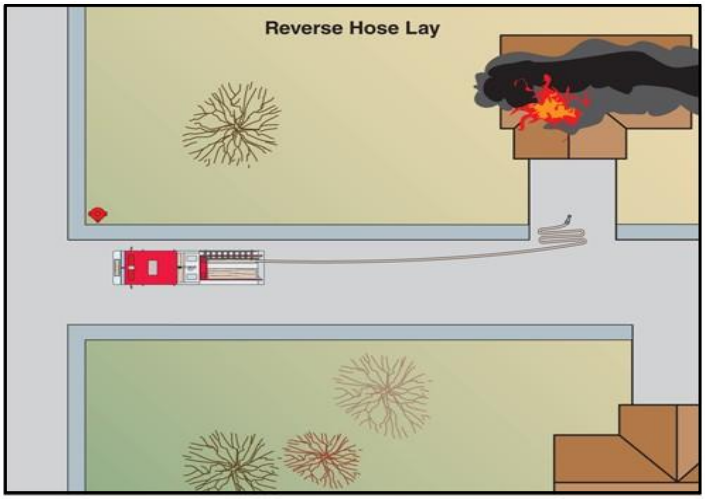


Fig. 1-2 (IFSTA)



The Engineer should position the apparatus for a Forward Lay whenever the need for water supply is determined. A hydrant in the immediate vicinity of the fire building may be used if it allows for a rapid stretch and will not interfere with Ladder Company positioning.

The first arriving Engine Company Officer will make the determination for the need for water supply or communicate that responsibility to the next appropriate arriving Apparatus. In either case that information is transmitted from the first arriving to the second arriving apparatus.

When performing a Forward Lay, the connection shall be made using 5” LDH, in the event the 5” LDH connection cannot be secured on the hydrant a minimum of 2-3” hoses shall be connected, one on each side of the hydrant. Pony lines are acceptable where connections are short as long as “5” LDH first” rules are applied. Note: When stretching hose lines from the apparatus. The apparatus should be positioned so that it will not interfere with Truck Company operations.

In order to establish and maintain proper pumping pressures, all Engineers must know how many hoselines, the size and length of the hoseline, the type of nozzles being used, and their flow. It is imperative that the Engineer listen closely to the radio at all times for traffic concerning charging, shutting down or adjusting hose line pressures on hose lines. They should also monitor the residual pressure of the pump master intake gauge to determine the capability of supplying additional volumes when available or as needed.

NOZZLE FIREFIGHTER

Photo 1-6: The Nozzle Firefighter preparing entry a residential fire.

The firefighter assigned to the nozzle occupies one of the most challenging and dangerous positions on the fire ground. The duties associated with the nozzle position routinely take this firefighter in close proximity to the fire. When not otherwise assigned the Officer is part of the fire attack team, they will have direct contact and supervision over the Nozzle Firefighter. The Charlie Firefighter fills this position. If tandem, the driver of the ambulance will fill this position.
(Photo1-6)

TOOLS *(Photo 1-7)*

Photo 1-7: The tools of the Nozzle Firefighter.

- Appropriate attack line
- Nozzle
- Radio
- It is recommended the Nozzle FF have a hand tool in a scabbard but not required

RESPONSIBILITIES

The Nozzle Firefighter's responsibilities at a structure fire can be broken into the three basic phases of an incident: responding to, on arrival, and suppression.

A. Responding to:

For the Nozzle Firefighter one key piece of information, they need while responding to a fire is the occupancy type. Using a 1 ¾" on a one to two room involved residential structure, an extended line (alley lay) on a garden style apartment, or a 2 ½" hoseline on a commercial building would be common examples of the occupancy dictating the line used. Those occupancies that contain standpipe systems will require the Nozzle Firefighter to bring hose bundles and other tools based on the Engine Company Officer's size up and tactics.

B. On Arrival:

Depending on the arrival order and the fire conditions the Nozzle Firefighter's duties are as follows:

1st Due-nothing showing and Alarms:

In those situations where the 1st due engine arrives and is operating in the **Investigation Mode**, the Nozzle Firefighter will stand fast at the engine, conduct a visual size up of the building, estimate the possible length of the stretch, and determine the size of the line that may be needed while the Officer and Back-Up Firefighter are inside the building investigating.

1st Due-working fire:

Under the direction of the Engine Company Officer the Nozzle Firefighter is responsible for stretching the first hoseline to the point of entry where fire attack will be initiated. In most situations the Nozzle Firefighter is responsible for the first 100' of hose and the nozzle (lead length). In circumstances where the Back- Up Firefighter is performing other duties (i.e. water supply, forced entry, etc.) that are not associated with the stretching of the hoseline, the Nozzle Firefighter is responsible for stretching and flaking the entire hoseline.

The occupancy size and type will determine the line selection and length of line. Some examples of handline selection may include:

- Single story residential

  Generally, this structure can be handled with a 150' 1 ¾" preconnect. If the structure is set back from the street greater than 100 feet, then consider using a 200' preconnect.

- Multiple story residential

  Strong consideration should be given to use of the 200' 1 ¾" preconnect or a longer hoseline taken from the 1 ¾" "Bulk Load" based on set back from the street and size of the structure due to the potential need to operate the hoseline on the upper floors.

- Apartments/ Long setback Townhomes
  Due to the complexity of access, construction type and water supply the 1 ¾" preconnect may not be the best option at fires in these types of structures. For fires in center hallway apartment buildings, garden style complexes, and long setback townhomes the 3" or 2 ½" with 1 ¾" extended lay (alley lay) may be the most efficient option. During extended lay operations, the Nozzle Firefighter is responsible for deploying the 1 ¾" Minuteman to the area where it can be stretched near the point of entry. The Nozzle Firefighter is responsible for communicating to the Back-up Firefighter the point of attack line stretch.

- Commercial buildings
  This manual recommends the use of 2 ½" hoselines on these types of buildings due to the potential for large volumes of fire that may be encountered. It is also recommended that in commercial building fires that a minimum of 100' of working line be stretched and flaked for use interior. The Nozzle Firefighter will need to account for this additional 50' when they are estimating their stretch.

2nd Due-working fire:

The priority of the 2nd due arriving engine Nozzle Firefighter changes with IC assignments. Traditional assignment will be either a secondary line or RIT operations.

If the assignment given is a secondary line, the 2nd due Nozzle Firefighter will concentrate their efforts to stretching and advancing the secondary line. The IC will determine whether that line is to be an additional attack line, a backup line, or exposure line.

If the assignment given is RIT operations the Nozzle Firefighter will accomplish any assignments or tasks assigned by the RIT officer.

C. Suppression:

The Nozzle Firefighter stretches the hoseline with the nozzle attached to the Location as ordered by the company officer. This location should be a safe area in proximity of the fire area such as a porch, stairway landing, hallway or adjoining area. After flaking out the line in preparation for its advancement, the Nozzle Firefighter should complete donning all required personal protective equipment. Caution should be used to not don in a doorway or other opening that might become involved in fire. When the line is flaked and the Nozzle Firefighter is ready, they will signal the Engineer to charge the hoseline. This signal may be verbal, by radio, or by hand signal. The following six procedures should be known and practiced by all firefighters assigned to the nozzle:

1. The Nozzle Firefighter must prepare to bleed the line of any trapped air (Flow for minimum 5 seconds) and ensure the pressure and pattern is correct. This is done with the nozzle fully opened and the stream directed away from the opening. The Nozzle Firefighter should ensure that if a combination tip is being used, it is fully rotated to the right or straight stream position. ("Right to Fight")

2. While operating the line the Nozzle Firefighter should hold the nozzle at arm's length, out in front. This position allows the firefighter to redirect the nozzle quickly by simply bending the several feet of hose in the desired direction. ***(Photo 1-8)***

Photo 1-8: The Nozzle Firefighter operating the nozzle at arm's length.

3. The Nozzle Firefighter should take a position within the structure that best utilizes the reach of the stream and maximizes the coverage of the room. Operation of the nozzle in an inverted "U" pattern while directing the Stream into the fire area pushes the heat, fire and stream ahead of the fire attack team. As progress is made, the stream is lowered and directed toward the main body of fire.

4. The floor must be swept with the stream before advancing. This action cools hot Or burning debris located on the floor while removing other potentially dangerous objects such as broken glass from the path of the advancing firefighters.

5. As a general rule, applying water on smoke should only occur when the associated heat conditions require cooling the overhead prior to advancing further into the building. If the overhead is to the point where flashover could occur, then flowing water into the smoke and rapidly and aggressively cooling the environment may be the only way to prevent the flashover from occurring. Forward advancement of the hoseline should only proceed after the threat of flashover has been eliminated.

NOTE: *The Nozzle Firefighter should never enter the fire area without water. To do so could allow the fire to rapidly extend and overtake the nozzle team causing burns to them and any fighter operating behind or above them.*

BACK-UP FIREFIGHTER

The Firefighter assigned to the Back-Up position is typically the third firefighter on the hoseline. Much of the success of the advancement of the hoseline falls squarely on the shoulders of the Back-Up Firefighter. Some of the hose management responsibilities include: 1- chasing kinks; 2 -managing the hose; and 3 -supporting the movement of hose around corners and through doorways. Failure of the Back-Up Firefighter to complete these tasks will lead to the delay in the initial attack line progressing to the seat of the fire. Because of these reasons, it is not uncommon for this position to be assigned to a more experienced Firefighter on the crew. ***(Photo 1-9)***

Photo 1-9: The Back-Up Firefighter plays a pivotal role in the advancement of the hose line.

TOOLS *(Photo 1-10)*

The six standard tools of the Back-Up Firefighter include:

Photo 1-10: The tools of the Back-Up Firefighter.

- Radio
- Box Light
- Irons
- Water-Can
- Rope bag

RESPONSIBILITIES

The Back-Up Firefighter's responsibilities at a structure fire can be broken into the three basic phases: responding to, on arrival, and suppression.

A. Responding to

Due to the many variables that the Back-Up Firefighter is responsible for there is some critical information that they must know going into the incident.

Arrival Order:

The arrival order of the engine company will change the responsibilities of the Back-Up Firefighter. These duties assignments can range from making a hydrant connection on a forward lay of a first arriving engine, to the stretching of an additional hand line as a third arriving engine.

Occupancy type:

The type of occupancy that the Engine Company is responding to will also determine the tool assignment of the Back-Up Firefighter such as bringing the water-can while investigating a smoke condition on a residential to shouldering hose bundles on a high-rise fire.

Call narrative:

The supplemental call information is vital not only to the Officer but to the Back-Up Firefighter because this will dictate their tactics, tools, and responsibilities. The “smoking outlet” call will require significantly different actions compared to a working fire with trapped occupants.

B. On Arrival:

The Back-Up Firefighter should rely on their experience backed by good judgment, and the information they received from the dispatch to determine the proper tool selection that meet the needs of the incident. Depending on the arrival order and the fire conditions the Back-Up Firefighter's duties, tools, and assignments are as follows:

1st Due-nothing showing and Alarms:

- **Occupancy types**
    - **Single family dwellings**

Tools: The tool selection for the Back-Up Firefighter during the Investigation Mode should include the water-can and the Irons.

Forcible entry: The Back-Up Firefighter has the responsibility of assisting the Company Officer with light forcible entry if needed during the investigative mode.

Recon: The Back-Up Firefighter will assist the Company Officer when the engine is in the Investigative mode. This could include helping determine the cause of an internal alarm, to locating a smoke source. If during the investigation mode a small fire is discovered the Back-Up Firefighter will be able to use the water can to extinguish or hold the fire in check until a hoseline can be deployed.

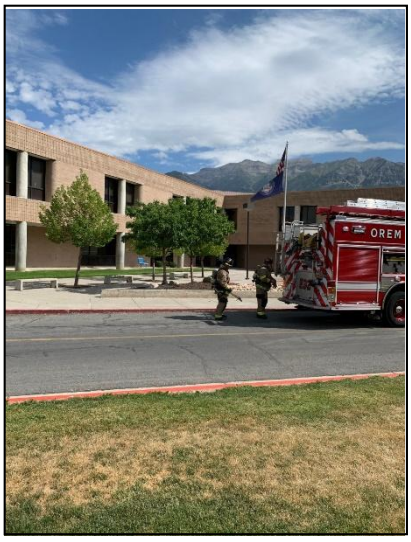
Water supply: The Back-Up Firefighter has no water supply responsibilities during the investigation mode. Those responsibilities are deferred to the Engineer of the 1st due or to the 2nd due engine.

- **Multifamily dwellings**

Tools: The tool selection for the Back-Up Firefighter during the Investigation Mode will be a rope bag for the possibility that a hoseline or tool needs to be hoisted. It is also recommended that he/she bring a Halligan and a box light.

Forcible entry: If the company officer initiates forcible entry and encounters a difficult door, he/she may request additional help from the back-up firefighter. This may or may not be accomplished after the hoseline is stretched (Company officers' discretion.)

Recon: The Back-Up Firefighter will assist the Company Officer when the engine is in the Investigative mode. This could include helping determine the cause of an internal alarm, to locating a smoke source. If, during the investigation mode, a small fire is discovered, the Back-Up Firefighter will be able to use the water can to extinguish or hold the fire in check until a hoseline can be deployed.



Water supply: The Back-Up Firefighter has no water supply responsibilities during the investigation mode. Those responsibilities are deferred to the Engineer of the 1st due or to the 2nd due engine.

- **Commercial**

Tools: The tool selection for the Back-Up Firefighter during the Investigation Mode should include the water-can, the irons, and other tools need for forcible entry (rotary saw, K-tool, etc.)

Forcible entry: The Back-Up Firefighter has the responsibility of assisting the Company Officer with light forcible entry if needed during the investigative mode.

Recon: The Back-Up Firefighter will assist the Company Officer when the engine is in the Investigative mode. This could include helping determine the cause of an internal alarm, to locating a smoke source. If during the investigation mode a small fire is discovered, the Back-Up Firefighter will be able to use the water can to extinguish or hold the fire in check until a hoseline can be deployed.

Water supply: The Back-Up Firefighter has no water supply responsibilities during the investigation mode. Those responsibilities are deferred to the Engineer of the 1st due or to the 2nd due engine.

1st due working fire:

- **Occupancy types:**
  - **Single family dwellings**

Tools: The tool selections for the Back-Up Firefighter for a working fire are the Irons and a Personal TIC.

Forcible entry: The back-up firefighter has the responsibility of starting forcible entry (if the truck company has not done so already.) The back-up should work on forcible entry by himself until either the company officer or the nozzleman can assist him.

Photo 1-11: The Back-Up Firefighter assisting the Officer with forced entry.

Door control: After forcible entry has been accomplished it is the back-up firefighter's responsibility to get a LFL (life, fire, and layout.) After the LFL has been accomplished it is the back-up firefighter's responsibility to close the door until the Nozzle Firefighters and the heel are ready to make entry. Once the Nozzle Firefighter is ready to make entry it is the back-up firefighter's responsibility to wedge the door open.

Hose management: One of the Back-Up Firefighters main objectives must be to support the movement of the hoseline to the seat of the fire. He/she can accomplish this in three ways: 1 chasing kinks; 2 exterior management of the hose; and 3 supporting the movement of hose around corners and through doorways. Failure of the Back-Up Firefighter to complete these tasks will lead to the delay in the initial attack line progressing to the seat of the fire.

Water supply: If a water supply is deemed necessary it is the back-up firefighter's responsibility to make the hydrant connection.

- **Multifamily dwellings**

Tools: On a multifamily dwelling the back-up firefighter will most likely be assisting with a long stretch. It is recommended that he or she takes a halligan and pack with a TIC.

Forcible entry: Most likely forcible entry will be completed by the company officer while he/she are accomplishing their recon. If a difficult door is encountered the back-up firefighter will assist the company officer in forcible entry after the stretch has been completed.

Photo 1-11: The Back-Up Firefighter assisting with the 3-Firefighter stretch.

Door control: After forcible entry has been accomplished it is the back-up firefighter's responsibility to get a LFL (life, fire, and layout.) After the LFL has been accomplished it is the back-up firefighter's responsibility to close the door until the Nozzle Firefighter and the heel are ready to make entry. Once the Nozzle Firefighter is ready to make entry it is the back-up firefighter's responsibility to wedge the door open.

Hose management: One of the Back-Up Firefighters main objectives must be to support the movement of the hoseline to the seat of the fire. He/she can accomplish this in three ways: 1 chasing kinks; 2 exterior management of the hose; and 3 supporting the movement of hose around corners and through doorways. Failure of the Back-Up Firefighter to complete these tasks will lead to the delay in the initial attack line progressing to the seat of the fire.

Water supply: If a water supply is deemed necessary it is the back-up firefighter's responsibility to make the hydrant connection.

- **Commercial**

Tools: Tool selection on a commercial building will be dependent on multiple factors. Some of those factors include size of the fire, length of the stretch, type of door that needs to be forced, and others.

Situation 1: If the stretch is a one firefighter stretch then the back-up firefighter can start accomplishing forcible entry. The tool selection for forcible entry on a commercial building should include the irons, rotary saw, and the K-tool.

Situation 2: If a longer stretch is necessary and the back-up firefighter is required to assist the Nozzle Firefighter with the stretch. The tool selection for this situation would call for a Halligan and a personal TIC.

Situation 3: If a water supply is necessary the back-up firefighter will make the hydrant connection. Then he/she will assist with forcible entry if necessary. The tool selection in this situation would be any extra tools needed to assist in a difficulty force such as a rotary saw, K-tool, etc.

Photo 1-11: The Back-Up Firefighter assisting forced entry of a commercial door.

Forcible entry: See the above “situations.”

Door control: After forcible entry has been accomplished it is the back-up firefighter’s responsibility to get a LFL (life, fire, layout.) After the LFL has been accomplished it is the back-up firefighter’s responsibility to close the door until the Nozzle Firefighter and the heel are ready to make entry. Once the Nozzle Firefighter is ready to make entry it is the back-up firefighter’s responsibility to wedge the door open.

Hose Management: One of the Back-Up Firefighters main objectives must be to support the movement of the hoseline to the seat of the fire. He/she can accomplish this in Three ways: 1 chasing kinks; 2 exterior management of the hose; and 3 supporting the movement of hose around corners and through doorways. Failure of the Back-Up Firefighter to complete these tasks will lead to the delay in the initial attack line progressing to the seat of the fire.

Water supply: If a water supply is deemed necessary it is the back-up firefighter's responsibility to make the hydrant connection.

NOTE: *After forced entry has been addressed, and the hoseline is charged and ready to advance, the Back-Up Firefighter's sole purpose must be to support the movement of the hoseline to the seat of the fire. They can place their tools* near *the entrance, and out of the way, so that when they are ready to use them They know where they are.*

Regardless of arrival order, or whether a Tailboard firefighter is staffed the Back-Up Firefighter is responsible for the hydrant connection on a forward lay.

2nd Due-working fire:

Tools: The tool selection for the back-up firefighter of the 2nd due engine on a working fire should be based on the occupancy type and assignments.

Water supply: Regardless of arrival order, the back-up firefighter is responsible for a hydrant connection of on a forward lay or reverse lay.

Supporting the 2nd due assignments: (Assisting with the primary attack line, Secondary line, or RIT)

Photo 1-11: Regardless of the arrival order, the back-up firefighter is responsible for the hydrant connection on the forward or reverse lay.

- Return to your company and assist with primary attack line.
- Return to your company and assist with any secondary lines pulled (Secondary attack line, exposure line, backup line, etc.)
- Return to the company and assist with RIT deployment and assignments.

C. Suppression:

If forced entry is not needed, the Back-Up Firefighter will focus their efforts on hose work. There are three key elements to hose work: ***(Photo 1-12)***

- Assisting with the stretch of the attack line or supply line
- Flaking out the attack line and chasing any kinks.
- Assist with the advancing and movement of the attack line.

Photo 1-12: The Back-Up Firefighter positioned at the door managing the hose.

<u>Stretching</u>

- **Preconnected Lines:**

  Ensure that all hose is cleared from the Bed

- **2 ½" Extended Lays:**
  After the length of the stretch has been estimated, the Back-Up Firefighter controls the number of lengths that are pulled off the hose bed, then coordinates the break and connection of the hose to a discharge with the Engineer.

- **LDH**:

  Hand jack LDH back to the hydrant and complete the connection for water supply operations.

Flaking

After the attack line is stretched, the next function of the Back-Up Firefighter is to make sure that the hose is properly flaked and kink free up to the lead length while the Nozzle Firefighter is waiting for water. Although the Nozzle firefighter is responsible for the lead length, the Back-Up firefighter should visualize and ensure that the entire line is kink free. ***(Photo 1-13)***

Photo 1-13: The Back-up Firefighter should visualize the lead length to ensure there are no kinks.

Flaking out a hoseline can be accomplished using several methods depending on the conditions encountered. The following options can be used:

- **One/Two Residential Dwelling and Garden Style Apartments:**

  On fires involving these types of dwellings the hose is generally stretched, flaked and charged outside the structure before advancing inside. When possible, it is good practice that the hose be flaked perpendicular to the point of entry. This technique allows the Back-Up Firefighter to move hose inside more efficiently during the advancement.

- **Multi-family dwelling with public hallways:**

  - The hoseline can be flaked out in the hallway on the fire floor before charging, if conditions allow. An example of this would be: the apartment door is intact, no fire in the hall, and light smoke conditions. A good rule of thumb is if you are masking up, you should be calling for water.

  - The hoseline can be flaked out into the adjacent or opposite apartment on the fire floor. This tactic is useful when a small hallway is encountered, and the hose cannot be laid up the open stairwell.

  - The hoseline can be fully or partially flaked out in the hallway on the floor immediately below the fire floor. This option is utilized when using an open stairwell and the volume or intensity of fire prevents access to the fire floor for flaking out the hoseline.

- The hose can be flaked up the stairs above the fire floor when in an enclosed stairwell. After the hoseline is charged the weight of the water in the line moving down the stairs will assist the firefighter assigned to the door position feeding the line into the fire area.

Advancing

The primary operational area for the Back-Up Firefighter, after assisting with the stretch, is at the door to the fire building. After the Nozzle Firefighter calls for and receives water at the nozzle, the Nozzle Firefighter and Officer, or Tailboard FF if staffed, will enter the fire area. At this point, the Back-Up Firefighter slowly feeds the line to the advancing nozzle team from their position at the doorway. Whenever possible, they should avoid operating directly in the door opening, because this will impede access, egress, or block ventilation operations. ***(Photo 1-14)***

Photo 1-14: Standing in the doorway will block access and egress.

The Back-Up Firefighter must not push the hoseline to the nozzle team, but instead feed hose at the speed of the nozzle team so that the hoseline advances easily.

It is sound practice to have the Back-Up Firefighter's SCBA mask donned but not on air if the conditions allow. Should the need arise for the Back-Up Firefighter to bump up they can simply click in the regulator and proceed inside.

Another important task of the Back-Up Firefighter is to monitor and observe heat, smoke and fire conditions as advancement is made. The Back-Up Firefighter is in a prime location to detect a sudden change in smoke or fire conditions between the doorway and the nozzle. Should conditions change, the Back-Up Firefighter must warn the Company Officer of these changing conditions.

TAILBOARD FIREFIGHTER

The Firefighter assigned to the Tailboard position is typically the second firefighter on the hoseline. When the Engine company remains together (not split) the Tailboard Firefighter assumes the "working" tasks of the Engine Company Officer. This positioning allows the Company Officer to return to the preferred supervisory role. Additionally, the tailboard firefighter can fulfill roles not being completed by another position as appropriate or assigned by the officer. Because of these reasons, it is not uncommon for this position to be assigned to the most senior Firefighter on the crew. ***(Photo 1-15)***

Photo 1-15: The Tailboard Firefighter assumes the "working" tasks of the Engine Company Officer.

TOOLS *(Photo 1-16)*

The standard tools of the Tailboard Firefighter include:

Photo 1-16: The tools of the Tailboard Firefighter.

- Radio
- Box Light
- Tool(s)
- Rope bag
- 4-gas

Fire Behavior and Reading Smoke

2

Notes

-FIRE BEHAVIOR-

FIRE BEHAVIOR

Understanding fire behavior characteristics is a necessity for all members of the engine company to properly advance a hoseline and extinguish the fire in a safe and expedient manner. Today's fires burn at a rate ten times faster with rapidly increasing heat compared to fires of just 20 years ago. Fire behaves differently with each type of building construction. Some buildings hold heat and limit the amount of fire spread while other structural types have common spaces that allow for fire travel and extension. Differing types of construction can add fuel to the fire load. Understanding the stages of fire growth and how rapidly fire ignites and spreads allows engine company members to better function on the fireground. ***(Photo 2-1, 2-2)***

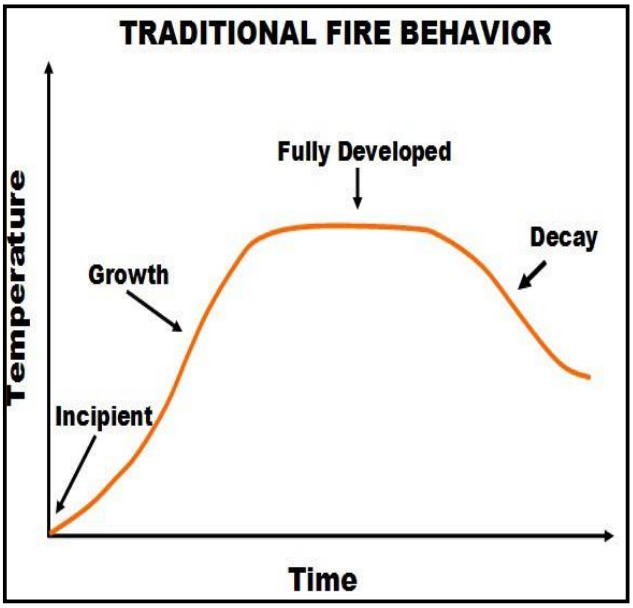


Photo 2-1: Traditional Fire Development Growth Curve

Fire stream selection must be coordinated with proper ventilation to confine and extinguish the fire. Various fire stream selections must be understood and their application used properly to advance to and extinguish the fire.

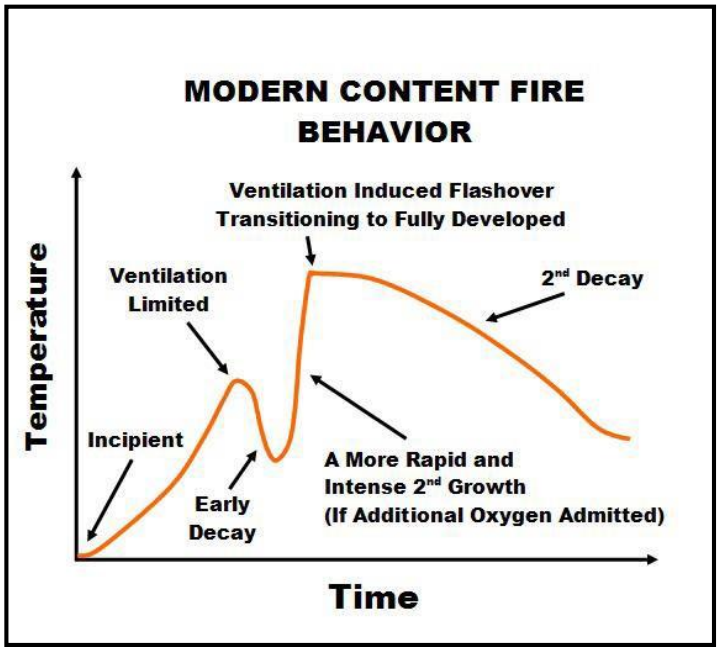


Photo 2-2: Modern Fire Development Growth Curve

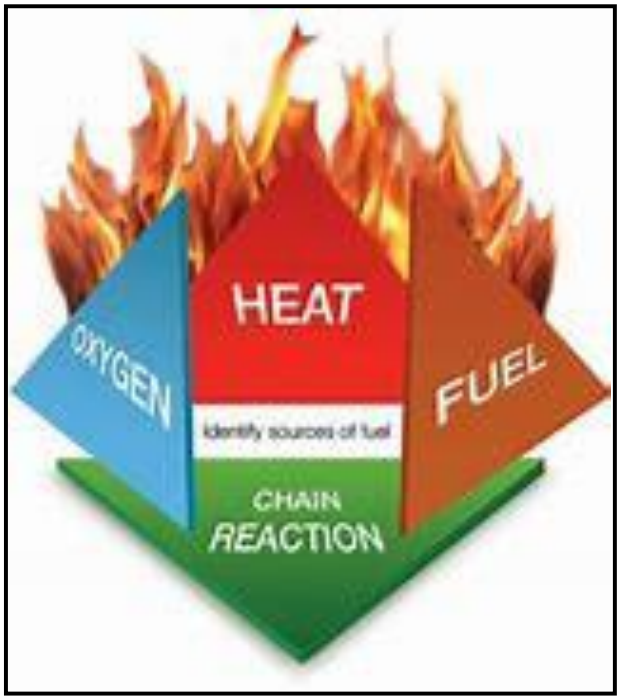


Photo 2-3: The Fire Tetrahedron

The Fire Tetrahedron

In order for combustion to occur, each component of the tetrahedron must be in place. ***(Photo 2-3)*** If ignition has already occurred the fire is extinguished when one of the components is removed from the reaction.

1. Oxygen – Enables a fire to sustain combustion.

2. Heat – Needed to raise the material to its ignition temperature.

3. Fuel – Any combustible material in the form of a solid, flammable liquid, or gas.

4. Chain Reaction – Fire ignition when the three elements are present in their necessary condition.

Understanding the following IDLH conditions enables firefighters to have a better understanding of what is confronted when approaching or operating in an IDLH environment.

Flashover

Flashover is the stage of a fire at which all surfaces and objects within a space have been heated to their ignition temperature and simultaneous ignition of all surfaces and objects in the space occurs. Flashover occurs at the point between the growth and fully developed stages. ***(Photo 2-4)***

Photo 2-4: Flashover

Backdraft

A backdraft is ventilation induced fire behavior that occurs when additional oxygen is introduced into a smoldering fire as heated gases enter their flammable range and ignite with explosive force. Backdraft conditions typically exist during the decay stage after the fire compartment has consumed all available oxygen.

Rollover

Rollover is observed when flames present in layers of smoke as a result of heated gases that are pushed under pressure from the fire area into uninvolved areas.

Thermal Layering

Thermal layering is the tendency of gases to form into layers according to temperatures.

Stratification

Stratification is layering of smoke and gas clouds.

Pyrolysis

As solid fuels are heated, combustible gases are driven from the substance – this process is known as pyrolysis.

Stages of Fire Growth

Firefighters should understand how fire develops and changes during a fire. The four fire growth stages are: ***(Photo 2-5)***

1. The incipient stage
2. The growth stage,
3. The fully developed stage,
4. The decay stage.

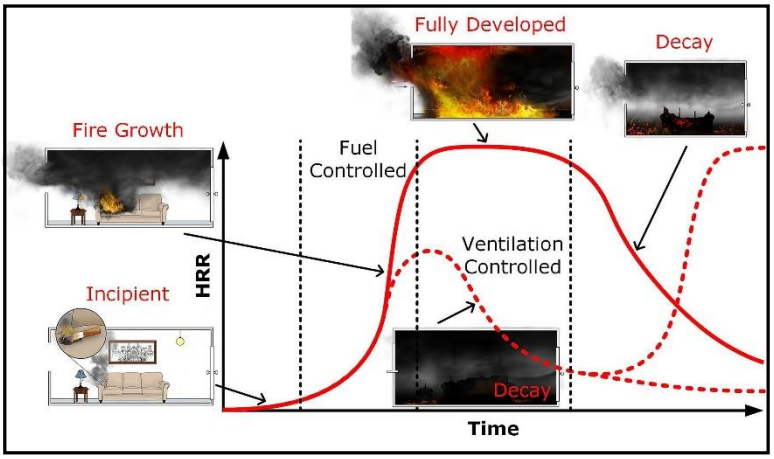


Photo 2-5: The Temperature curve and stages of fire.

The Incipient Stage begins when heat, oxygen, and a fuel source combine and have a chemical reaction resulting in fire. This is also known as ignition and is usually represented by a very small fire which often self-extinguishes, before the following stages are reached.

The Growth Stage occurs when the fire increases in size from small flames to full fire that involves the entire room. It may be a rapid event taking seconds to occur or a prolonged event taking hours relying on the following variables: ***(Photo 2-6)***

- Combustible content (fuel load including contents and structure).
- Oxygen supply (pre-existing, fire created, or firefighter created ventilation).
- Room size.
- Insulating qualities of the compartment (room).

Photo 2-6: The Growth stage of fire.

During the Growth Stage, fire develops and rollover is often seen in an adjacent compartment. This rollover should serve as a warning that the fire area may be reaching the point of flashover. As the fire progresses through the Growth Stage and into the Fully Developed Stage the potential for flashover exists. Radiation feedback from the ceiling and walls heats the smoke and gases given off by the burning materials and the combustible contents of the room. When the contents have been heated to their ignition temperature, flashover of the compartment can occur.

During the Fully Developed Stage, the entire room and contents are involved in fire. The fire will continue to burn until the available fuel and oxygen in the room or area is consumed or extinguished. ***(Photo 2-7)***

Photo 2-7: The Fully Developed stage of fire.

The Decay Stage occurs once all available oxygen is consumed. Although some oxygen remains in the fire area, visible flames start to diminish, and the fire continues to smolder. High heat and smoke conditions remain and the potential for ventilation induced fire behavior is present which can produce violent shock waves that can shatter windows and cause walls to collapse.

Modern Fuel Loading

There has been a steady change in the residential fire environment over the past several decades. These changes include larger homes, more open floor plans, lightweight truss construction, and increased synthetic fuel loads. The difference between the new and the old is referred to as modern vs. legacy. Legacy materials consist of natural materials, such as cotton, wicker, solid wood, and dimensional lumber. Modern materials are man-made materials, such as plastics, synthetics, polyurethane, and polyester.

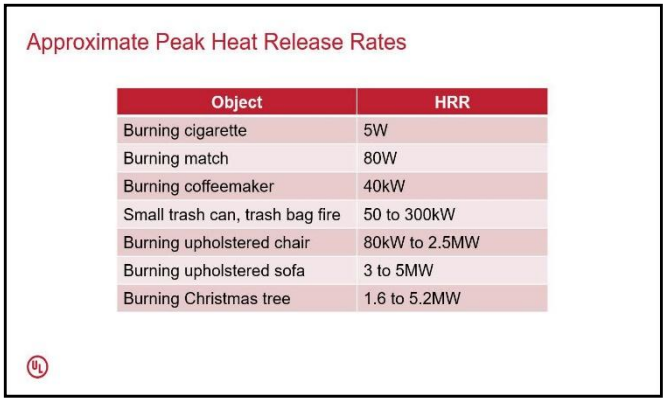


Photo 2-8: HRR of Common Household Objects.

Firefighters must understand the difference between modern and legacy materials, especially as it relates to the Heat Release Rate (HRR). HRR is simply defined as the amount of energy released over time. ***(Photo 2-8)*** It is the driving force for fire – the engine that is driving the fire. HRR is much higher for modern materials. This results in modern materials leading to flashover much quicker than legacy materials. Personnel should understand that HRR, combined with uncoordinated ventilation, will lead to early flashover.

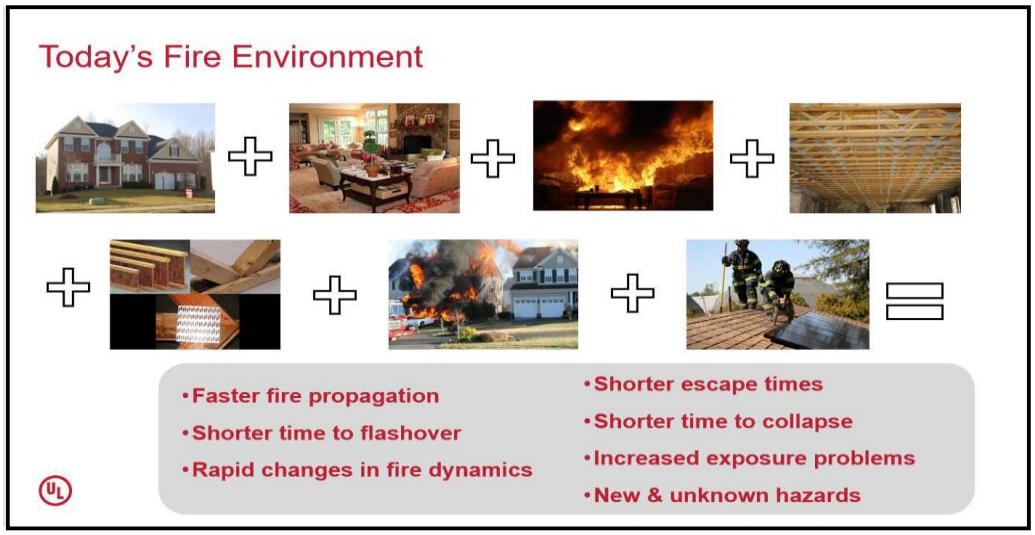


Photo 2-9: Today's Fire Environment: Larger Homes, More Furnishings, Synthetic Materials, Open Floor Plans, Lightweight Construction, Closer Structures, and New Technologies.

Modern materials, with their very high HRR, present a significant hazard to today's firefighters. It results in fires burning faster than ever before, with a high threat to life safety. ***(Photo 2-9)*** This leads to fires reaching the flashover stage much quicker than with legacy materials. Companies must be efficient in their operations and deliberate in their actions to minimize any delays, especially with stretching and operating the initial attack line and performing ventilation.

Ventilation's Effect on Fire

Effective engine company operations rely on the company's ability to advance to and extinguish the seat of the fire and all other areas of fire extension inside and outside the structure. The quicker the engine company can advance the line into the structure the better chance they have of limiting fire damage and decreasing the time crews spend operating inside the structure in a potentially unstable environment. Coordinated ventilation is a necessity for today's interior structural fire attack to enable the company to quickly and safely advance their line to extinguish the seat of the fire.

Photo 2-10: Vertical Ventilation Operation

Ventilation needs should be identified when the fire officer complete their size-up. This occurs as the lap of the structure is conducted and the fire's location is predicted, the ingress/egress points are identified, and the ventilation points are determined. These ventilation points include those that the fire created, those ventilation openings that were created by the occupants, and those ventilation openings the firefighters on the scene need to create to improve interior conditions.

These openings enable the engine company to advance and place their hoseline in service. These ventilation openings should not be restricted to windows and doors, but should include horizontal ventilation such as windows, doors, and gable areas, and the need to determine vertical ventilation. ***(Photo 2-11)***

Ventilation openings are air intakes and exhausts into and out of the structure that are created by the occupant (e.g., an open door/window), by the fire, or by fire department personnel operating on the scene. Oxygen is one of the most important elements to a fire and firefighters operating on the fireground create ventilation ports by performing routine fireground tasks. Every door and window opening can have desirable and undesirable effects on the dynamics of the fire.

Photo 2-11: Horizontal Ventilation Operation.

On most firegrounds, the first ventilation operation conducted is performed by the initial company arriving on-scene as they force entry.

All personnel operating on-scene must understand that changing the ventilation status of a fire not only provides oxygen to the fire but also changes the chemical profile of the smoke and fire gases, potentially taking a mixture too rich to burn and dropping it into its flammable range, further setting the stage for rapid fire development. This could be the simple act of opening a door for entry, and the impact that this type of action could have on fire development must be understood.

Photo 2-12: Coordinated Vertical Ventilation Operation.

A properly conducted structural ventilation process typically consists of the engine officer and outside vent crew exchanging information about the size-up, the engine company's hose stretch, and the ventilation openings that should improve conditions for the engine company advancing the hoseline. This information may be given face-to-face, over the radio, or through a predetermined plan that the companies plan for during routine training and drills.
A properly ventilated compartment/structure allows for a release of the smoke, heat, and fire gases that increases visibility and affords interior crews more favorable working conditions inside the IDLH environment.

Proper ventilation decreases the likelihood of a flashover or rapid fire development event and increases the life safety factor of all occupants and firefighters within the fire structure.

Ventilation guidelines relating to fire attack include:

- Air is introduced anytime a door is opened or a window is broken.
- Ventilation must be coordinated with the progress of the hoseline and the engine officer's order. ***(Photo 2-12)***
- The outside vent crew and engine company must coordinate on where and when to ventilate.
- Charged hoselines should be in place prior to ventilation in most situations.
- The engine company should observe the change in conditions prior to entering the structure and while advancing their hoseline within the structure.
- Do not ventilate windows and doors that do not need opening.
- It is not necessary to ventilate compartments that are not on fire or do not have a hoseline in close proximity.
- Doors being forced open must be controlled (hinged doors should be pulled shut until the crews are ready to advance through them).
- Large glass sliding doors should be cautiously vented due to the large air intakes that may be created and the breaking of these doors does not allow for closing if needed.

- Controlling the air getting to the fire limits fire growth and extension.
- Understand the impact of ventilation on the development of the fire.
- Consideration must be given to limiting ventilation to a tactical position at the fire room.
- An active fire pulls air to itself while pushing hot gases, smoke, and fire away.
- Wind speed and direction may have a dramatic effect on the fire.
- Indiscriminate ventilation will spread the fire.

Hydraulic Ventilation

Hydraulic ventilation is the process of removing large amounts of smoke, fire gases, and heat from the interior of a structure within the fire compartment. Using this technique quickly improves conditions within the compartment and increases visibility to enable the engine company to improve their environment.

The primary advantage to hydraulic ventilation is that it is quick and simple to perform by the engine company from within the structure. Firefighters do not have to set-up fans or make time-consuming vent openings. Hydraulic ventilation is also very effective at clearing a single room after knockdown has occurred.

The only tool required to perform hydraulic ventilation is a hose line with a nozzle. After firefighters have knocked down the fire in a room, they should advance to the closest window or exterior doorway. If no opening exists, the engine company will have to clear the vent opening then position the hoseline two feet from the opening and set the nozzle to a fog that will cover 80% of the opening and flow the hoseline out of the structure. The idea is to cover most of the opening with the stream and allow the smoke and heat to be drawn out between the stream and the opening. ***(Photo 2-13)***

Photo 2-13: Hydraulic Ventilation Operation.

The effectiveness of hydraulic ventilation is based on the size of the ventilation opening and the amount of water flowing from the nozzle. When ventilation begins, the nozzle should be fully opened so that maximum ventilation can be achieved. Finally, firefighters should be cautious of the water and any debris that are forced from the structure and be mindful of personnel operating immediately outside of the opening (e.g., outside vent team, command post, etc.).

- READING SMOKE-

Reading Smoke

Understanding smoke and smoke behavior has become an important aspect on the fireground. Smoke contains many clues to the location and status of the fire. In order to understand and interpret the various smoke conditions, engine company members must have a fundamental understanding of the characteristics of smoke. There are numerous classes and articles pertaining to the art of reading smoke. Many of them are extremely detailed with technical data making it difficult to understand and apply on the fireground. Engine company members must be able to read and interpret all clues while conducting a size-up and throughout the incident. The fireground principles of smoke are :***(Photo 2-14)***

Photo 2-14: Smoke contains many clues to the location and status of the fire.

1. Smoke is potential fuel.
2. Smoke density and color together are an indicator of the flammability.
3. Velocity (speed) and pressure are indicators of heat and flow path.
4. Volume is an indicator of fire intensity.
5. All of the above indicators form an incident profile regarding the location, status, and extent of the fire.

Potential Fuel

Products of combustion from modern day fuel sources produce an extremely toxic, highly flammable, and potentially explosive smoke filled atmosphere. The chemical composition of smoke varies from fire-to-fire based on the different fuel sources. All smoke is filled with high levels of carbon and carbon monoxide that if left unchecked will result in fire.

Density and Color

While many documents related to reading smoke separate density and color, it is acceptable to group them together to understand what they mean in context and application on the fireground. Smoke color is an indicator of two things: what is burning and flammability of the smoke. What is burning is less important than the flammability. Engine companies must understand when smoke is too lean to burn and when it is too rich to burn. This is critical when evaluating ventilation profiles and flashover potential. While fires have the ability to produce many different colors, the following colors are normally seen:

- White
- White/Grey ***(Photo 2-15)***
- Grey
- Grey/black or brown
- Black or brown

Black and brown smoke typically behaves the same regarding flammability but usually is an indicator of a different type of fuel Source.

Photo 2-15: White/Grey Smoke

Color of Smoke	Fire Status	Smoke Flammability
White	Indicates moisture or early stage incipient Class A fire	Too lean to contribute to fuel load
White/Grey	Indicates moisture or early stage incipient Class A fire	Too lean to contribute to fuel load
Grey	Early stage incipient/free burning fire with Class A and B fuel sour	Smoke possibly reaching the LEL level
Grey/Black or Brown	Fully developed fire with Class A and B fuel sources that is most likely ventilation-limited	Smoke is in the flammable range and subject to burn if heat is available
Black/Brown	Fully developed or decaying stag fire that is extremely ventilation-limited	Smoke is typically too rich to burn

Density refers to the smoke's thickness, which in turn translates into its concentration in air. Since smoke is fuel capable of burning, thickness shows how much fuel is laden in the smoke. In essence, the thicker the smoke, the more potential energy and more spectacular the flashover or fire spread will be.

By combining the density and color, personnel can gain a much better snapshot of what is occurring and use this information to predict flashover potential and decide on ventilation status.

Velocity or Speed

Smoke will present as fast moving or slow moving. The speed provides two critical pieces of information on the fireground: general location of the heat source and the fire's current flow path or air track. Smoke emitting directly from the fire is typically fast moving, rapidly expanding, and very agitated. As smoke leaves the fire, it will flow upward to the ceiling and begin migrating away from the fire. The heat of the expanding smoke is absorbed as smoke flows across the ceiling, walls, and doors. As the heat is absorbed, the smoke will become calm, orderly, or free-flowing. Viewed from outside a building, slow moving smoke flow could mean the fire is distant or that the compartment is still absorbing heat. Conversely, fast moving smoke flow seen outside the building could mean the fire is near or that the compartment cannot absorb any more heat. The other reason that smoke does or does not move has to do with the air track. If smoke is moving, it is getting air from somewhere, meaning the fire is continuing to grow. If the smoke is not moving, it is not getting any air, meaning the fire may be lying dormant waiting for additional oxygen or burned out.

Volume

Understanding the amount of fuels that are burning within a given space. This can help personnel understand the relative size of the event. For example, a small fast food restaurant can be completely filled with smoke from a small fire. Conversely, it would take a significant fire event to fill a big-box store with smoke. The volume of smoke leaving a building can help companies form an impression of the fire. Reading smoke volume is just a starting Place that paints the picture of the size and intensity of the incident. **(Photo 2-16)**

Photo 2-16: Volume of Smoke on arrival.

The fundamental understanding of these elements will give firefighters a better working knowledge of smoke and fire conditions. Recognizing a change in the smoke conditions is the best way for firefighters to maintain their personal safety by identifying, reacting, and preventing flashover or rapid fire propagation.

-READING SMOKE EXAMPLES-

Reading smoke example 1.

	Descriptio
Color	Black and grey
Density	Thick
Velocity/Speed	Moderate on Side Alpha /fast on Side Charlie
Volume	Box is full
Smoke Flammability (Potential Fuel)	Too rich to burn
Fire Status	Fully developed, ventilation limited
Fire Location	Probably Side Charlie, lower level – narrow fast moving smoke column
Ventilation Status	Ventilation limited – crews ventilated and smoke will begin to lean out
Summary	Fully developed fire with a large volume of moving smoke. Atmosphere Within the building was too rich to burn until ventilated by fire department personnel. Without the application of water, fire spread is imminent.

Reading smoke example 2.

	Description
Color	White/grey and black
Density	Thin on Side Alpha/ thick on Side
Velocity/Speed	Moderate on Side Alpha and Side
Volume	Box is full
Smoke Flammability (Potential Fuel)	Too rich to burn on Side Charlie
Fire Status	Fully developed on Side Alpha (white/grey smoke may be result of water application), substantial heat source on Side Charlie but ventilation limited to Side Charlie
Fire Location	Multiple compartments on first level
Ventilation Status	Ventilation limited on Side Charlie
Summary	Fully developed fire within multiple compartments that is extending into the attic; some compartments are ventilation-limited,

Reading smoke example 3.

	Descriptio
Color	Brown
Density	Thin on multiple sides
Velocity/Speed	Moderate speed-pushing smoke throughout entire attic
Volume	Box is full
Smoke Flammability (Potential Fuel)	Too lean on the outside and too rich inside the compartment
Fire Status	Decaying fire or extremely ventilation limited fire in the attic
Fire Location	Attic - A/B Quadrant
Ventilation Status	Ventilation limited
Summary	An attic fire that has a lack of oxygen. High temperatures in the attic space are indicated by the smoke staining on the exterior. The compartment is ventilation limited and careful coordination of reducing the temperature in the compartment

Fire Attack Principles and Practices

3

Notes

- FIRE ATTACK PRINCIPLES-

PROTECTION OF LIFE

Photo 3-1: The proper placement of the first hoseline saves more lives than all other fire ground operations.

The protection of life is the primary consideration at any fire ground operation. Engine Companies are often confronted with lifesaving operations upon arrival. These lifesaving operations are placed ahead of firefighting when enough firefighters are not available to do both, as is the case when there is no truck company on the scene. Judgment is a key factor when confronted with this situation. It must be determined that without immediate lifesaving actions a life or lives will be lost otherwise, the Engine Company must begin fire attack. The best lifesaving measure is almost always a prompt attack on the fire which, if allowed to spread, would trap occupants. All life hazards must be addressed by first arriving units, however, immediate rescue attempts by the first arriving engine company without simultaneously stretching and positioning a hoseline should be attempted only in EXTREME situations.

Factors impacting the decision to attempt an immediate rescue should include:

Photo 3-2: Stretching the first handline may be delayed by occupants threating to jump.

- Occupants endangered by being in the immediate vicinity of the fire.
- Occupants trapped and threatening to jump. **(Photo 3-2)**
- Means of egress cutoff by fire.
- Anticipated delayed arrival of the first due Truck Company.

Actions that the first arriving Engine Company must implement to protect endangered occupants include:

- Rapidly stretch and aggressively operate a hoseline to extinguish the fire.
- Position a hoseline between the fire and endangered occupants.
- Close doors to limit the spread of fire and smoke.
- Ensure that incoming companies are informed of the location of endangered occupants.

THE THREE PHASES OF FIREFIGHTING

Retired Deputy Chief Emanuel Fried-FDNY, states in his book, *Fireground Tactics*, that there is a logical sequence in firefighting, and it includes three phases: Phase 1-Locate the fire. (Not always an easy job-too many firefighters still use water on smoke). Phase 2 -Confine the fire. (Head it off and surround it). Phase 3-Extinguish the fire.

LOCATING THE FIRE

Before any fire attack can be initiated, or any hoselines stretched, the exact location of the fire must be determined. This is the first phase of the fire suppression effort. Information about fire location can be obtained enroute, upon and after arrival.

- Refer to response updates from dispatch and mobile messages can indicate fire location.
- Upon arrival, an exterior survey of the building should be conducted for visible flames, smoke, smoke blackened windows, or occupants in distress. (Photo 3-3)
- Additional information from occupants exiting the structure can help pinpoint the location of the fire.

Photo 3-3: Surveying the exterior of the building will help determine the location of the fire.

When arriving at the scene of a reported fire, check conditions on as many Exterior sides of the structure as possible. When entering a multistory building check each floor or look up open stairwells for indications of fire or smoke. If a particular apartment is suspected to be the fire location, but the door is locked and there are no visible indications of fire, try jostling the door for indications of smoke escaping from the door jam. Once the exact location of the fire has been determined it must be conveyed to the other companies operating on the scene. Fires in multistory and multifamily Dwellings require that the most direct route to the fire area must be relayed to the Engine Companies stretching hoselines.

CONFINING THE FIRE

Confining and controlling the fire is the second stage of the fire suppression effort and includes those actions taken to prevent the fire from extending beyond the area already involved. This is generally the immediate priority and fulfills the tactic of placing a hoseline between the fire and most of the building occupants. Confinement of the fire Must take into consideration the intensity of the fire as well as the known or anticipated direction of fire spread. Be aware that the fire may be extending via pipe chase, balloon construction, concealed spaces, or fire venting from window openings.

Depending on the type of building and fire location, the first line stretched and operated may be committed to confining fire extension by protecting an open stairwell while a second hoseline is utilized to extinguish the main body of fire. Simply closing the door of the fire room may keep the fire in check and prevent the spread of fire into other parts of the structure or into public hallways while hoselines are being stretched to the location.

EXTINGUISHING THE FIRE

Extinguishing is the third stage in the fire suppression effort. Initial extinguishment includes “fire control” of visible flames and extinguishment of smoldering debris. Final extinguishment means that any fire uncovered by “opening up” and overhauling procedures have been extinguished.

FIRE ATTACK METHODS

INDIRECT METHOD

The Indirect Method was developed during World War II as a means of combating fuel oil fires in the confined machinery spaces of large ships and later applied to structure firefighting. Lloyd Layman was the primary proponent of what he called the "indirect" method of structural fire attack". He explained the theory and methodology in his book *Attacking and Extinguishing Interior Fires*. Layman identified the following key requirements for a successful indirect attack:

- Fog streams should be remotely injected into the fire area at the highest possible level from positions outside the involved building due to the danger of steam burns to nozzle crews.
- The fire should be sufficiently well-developed, as fires in the first phase or early second phase are effectively suppressed using direct methods.
- Doors and windows in the fire building should be intact (shut), and ventilation must be delayed until after the injection of water fog has ceased.
- **Indirect attack methods, while potentially effective, have a limited range of application on the fire ground and must be carefully employed to achieve satisfactory results.**

COMBINATION METHOD

Advances in personal protective equipment, self-contained breathing apparatus, nozzle technology and maintaining the tradition of aggressive interior attack, forced the fire service to examine different methods in which firefighters applied water on fires. As a result of these needs, the Combination Method was developed by Keith Royer and Floyd Nelson at Iowa State University during the 1950's. Their studies expanded on Layman's principles and they determined that the Combination Method was more efficient for interior structural firefighting than the Indirect Method.

The combination attack requires the nozzle team to perform an interior fire attack using at least a 30-degree fog pattern directed at an upward angle and rotated rapidly in a clockwise motion to absorb a maximum amount of heat from the fire environment. As the seat of the fire is reached, clockwise sweeps with the nozzle should also provide some direct cooling of the fuel. The pattern also can be adjusted at this point to a straight stream to provide enough penetration for final extinguishment. **The combination method is characterized by excessive steam production; zero visibility due to disruption of the thermal balance; and the danger of pushing flammable fire gases, smoke, and flame into uninvolved areas of the building due to the high-pressure that**

ists ahead of all fog patternsEx. Without appropriate ventilation, the danger of forcing heat and flames up and over the heads of the nozzle firefighter is another real danger. Because of these dangers the combination is not recommended for interior firefighting operations!

****More Data is being collected on the effects of "pushing fire" with a fog nozzle**.

DIRECT METHOD

The Direct Method, and most common method, involves the direct application of water on the burning fuel to cool it below its ignition temperature and eliminate production of vapors that burn. There are four essential factors that affect the safe and efficient extinguishment of fires using the direct method:

- Have sufficient flow (GPM) to overcome the heat being produced by the fire. Many fire attack operations are unsuccessful simply because the size of hoselines are too small to deliver the proper flow needed to overcome the HRR and extinguish the fire.

- Select a nozzle pattern that can penetrate the heat created by the burning fuel. The goal is to get water on the fuel-flame interface without premature vaporization of the water and excess steam production.

- Have sufficient reach of the stream. This enables the nozzle firefighter to flow The nozzle from a safe distance and allow "the water to do the work." Do not open the nozzle on smoke, unless heat conditions demand cooling. The nozzle does not have to be so close as to risk burn injuries.

- Have timely and adequate ventilation. Ventilation is essential to remove combustion gases, smoke, and unwanted steam from the fire area while permitting an unimpeded advance to the seat of the fire. At ceiling temperatures of 1,000°F or more water expands over 4,000 times its original volume. Without a large opening through which to remove this superheated steam safely to the o u t s i d e .

Regardless of the type of stream--fog, straight, or solid--whenever a nozzle is opened in the fire building, conditions immediately worsen. Most visibility is lost, and it can become uncomfortably hot and humid even near the floor. There is no perfect fire stream, but a direct attack with straight or solid streams coupled with proper ventilation is far better than the combination method in maintaining more tolerable interior conditions.

SOLID STREAMS vs. STRAIGHT STREAMS

Photo 3-4: The straight stream from a combination fog nozzle

Although their use in direct attack is similar, straight and solid streams have distinct differences. A straight stream is, in essence, a very narrow fog stream. It is produced by a combination nozzle and is composed of millions of tiny water droplets separated by air entrained within the stream. A solid stream is produced by a smooth-bore orifice and is a compact, solid cylinder of water as it leaves the nozzle. With proper tip pressure, a solid stream will remain compact for a considerable distance before friction with the air, gravity, and other factors degrade the quality of the stream.

One important reason solid streams are more effective than straight streams in interior fire attack concerns water droplets. When a solid stream is deflected off the ceiling and walls, it produces droplets of sufficient Size and mass to reach the burning fuel without being carried away by thermal currents or vaporized prematurely by the heat of the fire. **(Photo 3-6)**

Photo 3-5: The solid stream from a smooth bore tip.

Straight streams, (which are broken streams created by changing the direction of water travel within the nozzle by striking the stream against a deflector), consist of countless small droplets that are made even smaller when striking the ceiling and upper walls. These smaller droplets, with the low mass, are drawn into and propelled out of the thermal column of the fire, never reaching the burning fuel but instead are vaporized, producing excess steam and wasting water.

- FIRE ATTACK PRACTICES-

INITIAL ATTACK STRATEGIES

Stretching and operating hoselines are the primary functions of the Engine Company that ultimately lead to fire extinguishment. A single Engine Company can only effectively stretch and advance one handline. The need for additional handlines will require additional engine companies. Lines are stretched into the building to extinguish the fire after the location of the fire has been determined.

The first and second Engine Companies may work together to get the first line into operation, when the fire is above the ground floor or a 2 ½" hoseline is the first line stretched. Some situations may require more engine companies to assist in stretching the first line. Every effort is normally made to get the first line into operation before a second line is stretched.

When life safety is a factor, the first line is positioned between the fire and those threatened. It is normally stretched into the building via the front door; however, it may be stretched via exterior stairs. Priority should always be given to protecting the means of egress and protecting the stairs. Civilians trapped inside a structure or exposed to heat and smoke are considered the primary exposures. When life safety is not a factor, then the first hoseline is placed between the fire and the most severe exposure. A hoseline placed to cover an exterior exposure should be positioned so that it can be used on the fire building with the possibility of moving it inside if needed.

Knowledge of the floor layout is a valuable asset to an engine company advancing under fire and/or smoke conditions. If the smoke is not banked down to the floor, A quick glance at floor level before opening the nozzle can give the nozzle firefighter and officer an indication Of the floor layout. From this position the furniture, debris or other obstacles which could interfere with the advance of the nozzle by the Nozzle Firefighter may be evident. The glow of the fire may indicate the direction and distance the hoseline must advance. Once the line is open, any visibility will be lost until adequate ventilation is accomplished. **(Photo 3-6)**

PHOTO 3-6: Back-Up Firefighter looking under smoke.

The nozzle must be bled, and the pattern set to a straight stream on combination nozzle before the engine company enters the fire area. Never enter the fire area with an uncharged hoseline. However, the hoseline should be stretched as close to the fire area as possible before being charged. When stretching to upper floors on multi- family dwellings, an uncharged hoseline is stretched more rapidly and it is less fatiguing than attempting to move a charged hoseline into position.

All firefighters should operate on the same side of the hoseline. When the door to the fire area is opened the crew should be low and to one side of the opening, to let the heat and gases vent prior to advancing. When possible, the line should be flaked so that the nozzle and lead length are on the hinge side of the doorway for inward swinging (Residential) doors and the knob side for outward swinging (commercial) doors. This initially gives the nozzle stream better coverage of the room as the door is opened. Do not crowd the nozzle firefighter, especially on a 1 ¾" line. Pin the line to the floor to absorb the nozzle reaction then be prepared to advance forward when needed. Once the line is advancing, keep moving toward the seat of the fire. In order to reduce the chance of burns and guarantee rapid knockdown, the nozzle should move aggressively and deliberately. Let the reach and penetrating ability of the stream do the work, especially in large area buildings or when several rooms are involved in fire.

The stream should be operated "out front and overhead". The water should be deflected off the ceiling and upper walls. The nozzle firefighter should hold the nozzle at arm's length to allow for maneuverability and charge of nozzle direction. ***(*Photo 3-7).**

Photo 3-7: The fire attack team operating the hoseline. Note the Nozzle Firefighter is operating the hoseline at arm's length.

As the fire darkens down, the angle of The stream may be lowered to directly cool burning material. Try to get as close to the fire as safely practical without risking burn injury

Do not open the nozzle onto smoke. Applying water on smoke should only occur when the associated heat conditions require cooling the overhead prior to advancing further into the building. If cooling the overhead is required, the fire attack team should apply enough water to cool down or drive back the heat

Conditions. "Penciling" is **NOT** an appropriate technique for the application of water and its use is discouraged. This technique works well in a "Flashover Trailer" to demonstrate how water application affects fire behavior but can be a fatal mistake when applied to pre-flashover conditions during actual fires. Potential flashover conditions should be eliminated, not delayed. In high heat conditions which drive the Engine Company to the floor, the nozzle should be flowed overhead ahead of the advance to cool the smoke and ceiling temperatures and prevent a flashover or roll-over.

If this action does not quickly improve the conditions then consideration should be given to backing out the hoseline until additional ventilation is completed.

The Officer must stay alert to the intentions of the Nozzle Firefighter and be able to quickly support that firefighter. When the Nozzle Firefighter wants to change the direction or elevation of the stream, the Officer must maneuver the section of hose behind the Nozzle Firefighter in the opposite direction. As the advance is made, listen for the crackling of fire, look for a glow in the smoke, and feel for increasing heat. Listen to the sound of the stream as you sweep the nozzle across the room or area. The sound of water striking a wall will change if an opening such as a door or window is encountered. This opening may lead to another room or hallway where fire is still burning.

A fundamental rule of Engine Companies is “do not pass fire”. When advancing a hoseline through a fire area consisting of several fire rooms, it is usually necessary to operate the stream from the doorway of each room. By utilizing the reach of the straight or solid stream, the fire can be knocked down in these rooms and the hoseline can be advanced rapidly to extinguish the remaining areas. This tactic may leave smoldering debris or window frames but there should be no visible flame in the areas passed. (The term “fire control” means to have control of the fire area without complete extinguishment. As the attack hoseline is advanced through the fire area all doors must be opened to ensure that the nozzle does not accidentally pass an area involved in fire.

Prior to advancing the hoseline to upper floors, it is always a good practice to check the lower floors for fire before proceeding to an upper floor position.

Once the fire appears to be knocked down, consider shutting down the nozzle to let the smoke and steam lift. Be prepared to reopen the nozzle at any moment. The floor should be swept with the stream as you advance to cool any burning material and prevent knee and leg burns. This action will also sweep debris from the path of the advancing engine company crew.

SUPPRESSION DIFFICULTIES

Some common situations which may result in the slowing or stopping of the attack hoseline advancement are:

Situation 1 – Fire will not darken down or cool down

An Engine Company is making good progress advancing through a fire area and is suddenly stopped or slowed by fire that will not cool or darken down.

Possible Causes

- The stream is not adequately penetrating into the fire area.
- The flow may be inadequate for the size/intensity of the fire.
- A heavy body of fire may exist in another area which the stream is not reaching or penetrating.

Possible solutions

- The stream direction may need to be adjusted to enter the room more completely or an advance of a few or more feet may be necessary to reach the seat of the fire.
- The gallons per minute (GPM) flow may be insufficient due to kinks in the line or low pump pressure. Removing the kinks or increasing the pressure should result in an increased flow and faster knock down of the fire. A 2 ½" hoseline may need to replace the initial 1 ¾" hoseline because of more fire than originally estimated.
- If fire exists in an area which is incapable of being reached by this hoseline such as the floor below or an adjoining area, the Engine Company should make a stand at this point and hold the fire until a second line can be stretched. The second hoseline can be stretched to the other area involved or can be advanced together with the first hoseline to attack the fire.

Situation 2 – Fire has darkened down but will not cool down

Possible causes:

- The material and furnishings in the fire area have not been completely extinguished.
- Fire has extended into the walls, ceiling, and/or void spaces and continues to burn.
- There is fire uncontrolled below this area.
- Inadequate ventilation of the fire area.

Possible solutions:

- The areas where the fire was knocked down may need additional water application to completely extinguish all material, furnishings and structural components.
- Wall, floor and ceilings must be opened up to expose and extinguish any hidden fire.
- Hoselines stretched to the floor or area below to check for and extinguish this fire.
- Initial or additional ventilation must be performed including the use hydraulic ventilation by the Engine Company.

If it becomes necessary to withdraw an attack hoseline from a position due to fire intensity, the stream must be kept in operation and the line should be backed out. Firefighters withdrawing a hoseline from an interior position in the fire area should never turn their backs on the fire. The hoseline with the nozzle flowing is the exiting Engine Company's lifeline. Should they lose or drop it they could get lost in the building or not be able to control the flashover/rollover that is taking place at the ceiling.

Stretching and Operating the Hoseline

4

Notes

- STRETCHING THE HOSELINE-

The stretching and operating of hoselines at fires is the primary function of an Engine Company. All members must realize the importance of the initial hoseline stretched at a structure fire. *More lives are saved at fires by the proper positioning and operating of hoselines than by all other means.* The majority of structural fires are controlled and extinguished by the initial line. There are three essential fundamentals that must be followed every time a hoseline is stretched:

- **Know the location of the fire before beginning a stretch.**
  This simple factor cannot be overlooked. Stretching short or to the wrong location can be a fatal mistake. Take the proper amount of time to determine the exact location on fires when the location of the fire is not obvious.

- **Estimate the amount of hose needed.**
  Determine how much hose is needed to get to the structure and then how much hose is needed inside.

- **Pre-fire plan the buildings in your first-in and second-in districts**.
  Identify those buildings where fires will be out of reach of the pre-connects. Practice stretching hoselines to those areas that require either an extended lay operation or hose from the rear hose beds.

- HOSELINE SELECTION-

The first and most important decision that the Engine Company will make after determining the location of the fire is which hoseline the Engine Company will stretch. The type of stretch, size of hose, and number of lengths will depend on many factors. This judgment will be based on the type of occupancy, the size and intensity of the fire, water source, and the needed rate of flow to control the fire. Interior operations inside residential structures are usually best accomplished with a minimum 150 gpm flow provided by 1 ¾" hoselines. This hoseline provides sufficient flow to extinguish multiple rooms of fire yet allows the necessary speed in stretching and flexibility in advancement required to operate in the interior of these structures. This can be accomplished by stretching either a preconnect (150' or 200'), using the 400' "bulk load", or using extended lay connected to 2 ½" hose, depending on the distance of the fire from the engine.

There are situations that the first arriving Engine Company may be faced with a fire that initially looks bigger than what a 1 ¾" hoseline may be able to handle but not quite big enough for a 2 ½" attack line. These "in between" fires can leave the engine company in a bad position if they choose the wrong attack line. Pull the 1 ¾" and there may not be enough GPM to stop the spread of the fire or pull a 2 ½ "and reduce the mobility of the attack line. The Acronym "ADULTS" can assist the Engine Company in determining when a 2 ½" hose line is recommended.

ADULTS

A- Advanced fire conditions on arrival.

D- Defensive operations.

U- Unable to determine seat or location of fire.

L- Large, un-compartmentalized area (supermarket, bowling alley, warehouse, etc.

T- **"**Tons of water". Any time you need to deliver a large volume of water 250gpm or more.

S- Standpipe operations

Another option available when the size of the fire makes it unclear which line to Pull is to use a 1 ¾" line connected to 2 ½" hose and shutoff. The advantage with this tactic is that if conditions deteriorate, firefighters can simply back-up, disconnect the 1 ¾" line, replace the 2 ½" nozzle and advance the 2 ½" line already stretched.

- ESTIMATING THE STRETCH -

One of the most important traits of a good firefighter is their ability to quickly and accurately estimate a stretch. Estimating the stretch can make or break the success of the initial attack line. In most instances the 150' preconnect provides enough working line for the average single-story residential house. Two and three-story residential structures are routinely handled by either the 150' or 200' pre-connects depending on the setback and size of the residence. However, in those instances, with long setbacks, commercial businesses, or in the case of a garden style or interior hallway multiple dwellings, estimating the stretch becomes an important component to the success of the initial attack line. Taking for granted, or failing to estimate accurately the amount of hose line needed to reach the seat of the fire, will lead to a delay in the suppression of the fire.

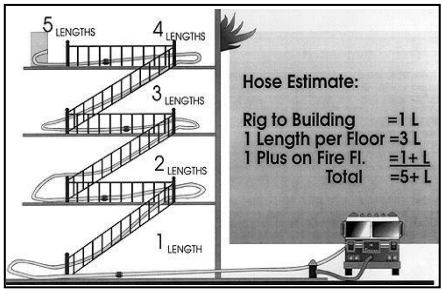


Photo 4-1: Proper estimation of the stretch is crucial for the success of the operation.

The general rule for estimating the number of lengths in a fire building is:

- 1 length for setback (engine to front door)
- 1 length per floor (interior stair well)
- 1 length for the fire floor
- 1 length per 3 floors (exterior or well-hole stretch)
- 1 length per residential property line to property line width

It is important to remember that the guidelines for estimating the stretch into the building require that a ***minimum*** of 50 feet of working line be available to use on the fire floor. If the hoseline is stretched up a well-hole opening in a stairwell, or exterior vertical then the general rule is 15' per story. Most often one length of hose will easily cover four stories but using three as the rule allows for extra hose to be available for the fire floor. Well-hole stretches and exterior vertical stretches are completed by flaking the working line or lead lengths on the floor below the fire and are secured with a hose strap at that point and every two floors below when necessary. These rules assume that the engine has stopped at the fire building or the required lengths are removed from the hose bed prior to the engine leading to a hydrant.

For large multiple dwellings or commercial buildings hose estimations must take into consideration the actual distance from the engine to the entrance door. In some cases, several lengths of hose might be required to reach the entrance door depending on the location of the engine to point of entry. The distance from the entrance door to the base of the stairway used must also be considered. This is in addition to the required one length per floor plus one for the fire floor. Some buildings may require ***two lengths or more for the fire floor.***

There are a few techniques that will assist the Engine Company in estimating the desired amount of hose that is needed to reach the seat of the fire. Below are general guidelines used to assist members in determining the proper length for a hoseline:

- The average width of a residential property plot is 50’.
- From the front door of a typical residence to the rear door, is usually covered with 50’.
- An additional 50’ of hose per story may be necessary to reach a fire on the upper floors of a large residential dwelling.
- A good rule of thumb for commercial buildings is to add the length and width of the building then use that number as the number of feet of 2 ½” needed. This technique assures that there will be enough hose to cover the entire interior.
- Try to break the stretch down into 50’ sections in your mind when determining a long stretch through a garden apartment complex.

- HOSELINE PLACEMENT-

Two critical considerations for firefighters to consider when preparing hoselines for fire attack, are the location of the “working line” with respect to the point of entry into the building, and the technique used to prepare the hoseline for entry into the building.

During the initial stretch and placement of the hoseline, the attack team should consider these basic concepts:

1. The working line and the attack team must be a safe enough distance away from the “point of entry” so they do not interfere with any forcible entry operations that may be needed prior to entering the structure. Additionally, the attack team should be far enough back from the entry point so they can protect the forcible entry team, and “cover” the door opening in the event the fire vents after opening the door.

2. Hoselines must be located far enough from the “point of entry” so crews do not subject themselves and equipment to intense heat and smoke or other unsafe conditions while getting ready for fire attack.

3. Before a nozzle team commits to the interior of a building, they must all perform a good size-up by reading the building & fire conditions. If they are back far enough to view more than one side of the building, it will be easier to establish where the seat of the fire is, and the layout of the structure.

This cannot be done well if firefighters locate themselves and the hose line right up close to the “point of entry”. Observe the building from a safe and reasonable distance while the hoseline is getting charged, and forcible entry is being performed.

FIRST HOSELINE

The first hoseline is placed between the fire and any persons endangered by it. This is accomplished by stretching the hoseline via the primary means of egress, usually the front door of a single-family dwelling, and leads to the main stairwell or public hallway of a multi-family dwelling. This tactic:

- Allows occupants to evacuate via the stairs.
- Allows members to proceed above the fire for search.

In almost all fires in residential structures, stretching the first line and entering through the front door is the best tactic as this will be the fastest, easiest, stretch, protect egress, give access to open stairwells, and lead to a quick extinguishment. This is how lives are saved; put the fire out as quickly as possible.

If it is determined there is no life hazard in the building, the first line is positioned between the fire and the most severe exposure. The most severe exposure does not necessarily mean where the fire is likely to spread. Lines must be stretched to protect life first but in the absence of a live hazard, the first line should be placed to protect the greatest amount of property.

When placing a hoseline to protect an exterior exposure, it should be positioned so that the stream can be used alternately between operating on the exposure and the fire. When using streams to protect exposed building, the water should be applied onto the building's surface for best results.

SECOND HOSELINE

Deciding on hoseline placement is one of the most important tactical decisions to be made on the fireground. The objective of the first hoseline will determine where the Second line is placed. Deciding on whether its purpose is for interior extinguishment, egress protection, or exterior knockdown will determine where this line is placed.

Historically, the second line is often referred to as the backup line. However, changes in tactics due to modern lightweight building construction precipitate the need to call this line the second handline. The second line may be put into service as an exterior attack line while the first line is being used to attack fire on the interior of the structure, it can be used for protection of the stairwell while the first line operates in the basement, or it may be positioned on upper floors to protect from vertical fire extension. The second hoseline shall be coordinated with the first hoseline and positioned accordingly, and tactical communication is vital for its effective deployment.

BACK-UP LINE

The back-up hose-line is a necessary component for any safe and aggressive fire attack and is usually the second or third line that is stretched. However, when conditions are not improving inside, or the volume and size of the fire is larger than the initial attack line can handle, it may be necessary for the back-up line to become an additional attack line. It is important that the decision to use the back-up line as the additional attack line is transmitted to the IC, so that another line can be put into place and serve as the backup line. Here is a list of situations where the back-up line should be used:

- An additional attack line is needed.
- Pressure loss to the attack line.
- Attack team is trapped by fire.
- Search team members egress is cut off.

Additionally, the back-up line should not be used by the RIT team. The RIT team should have their own dedicated hose line and not rely on the back-up line for their operations. The following are simple guidelines to use when given a back-up line assignment:

- **Stretch the back-up line to or through the same entrance as the attack line:** This ensures that the entire path of the attack team is covered.
- **Do not allow the deployment of the back-up line to delay, or interfere with** getting the initial attack line in position: Before stretching the back-up line, ensure that the attack line is kink free and pushing toward the seat of the fire. If the initial attack line is not moving for any reason, help the attack team advance. Extinguishing The fire is the quickest approach to ensure crews can exit the building safely.
- **Do not fight the fire using the back-up line**: The back-up lines job is to protect crews working inside. If you become involved in fighting the fire, you will lose sight of protecting those inside, such as search operations above you. If the Attack line is not capable of extinguishing the fire, and the back-up hose is needed to assist, then an additional line is needed to assume the job of the back-up line.

- **Be aware of all crew positions inside:** Even though this line is laid relative to the attack lines placement, this crew is not the only responsibility. Other members working inside must be able to safely exit as well. Search teams without a hose-line can be in more danger. Be aware of these situations and be prepared to protect everyone.

- **Provide a continuous water supply for the back-up line:** This line is to protect other firefighters. You will not be able to do this if your line runs out of water!

- **Protect stairwells, and other main vertical channels of fire spread:** The danger to crews working above a fire is to have fire come between them, and their route of egress. Positioning the back-up line by the stairwell ensures that the fire can be stopped from traveling upwards, and that it can be re-directed upstairs quickly if crews are in trouble.

- **Back-up lines must be at least the same length as the attack line:** The function of the back-up line is to protect crews working on the interior. This line must be able to cover all parts of the building that the attack line does. Longer lengths should be considered, if the first hoseline is stretched short. The back-up line can be redirected and become the primary attack line.

- **Back-up lines must be the same diameter, or larger than the attack line:** Again, the function of the back-up line is to protect crews working inside. Therefore, this line must be set up to perform that task. The type of building, fire conditions, and crew locations are all components of a size-up that the back-up team must consider.

THIRD HOSELINE

Depending on the occupancy and the fire conditions, a third hoseline may be required. This line may be stretched to:

- The floor above the fire
- Cover a second means of egress.
- Replace the back-up line if it is advanced into the occupancy.
- Protect exposures.
- Prevent vertical extension.
- Protect crews searching above the fire

OTHER TACTICAL CONSIDERATIONS FOR HOSELINE PLACEMENT:

1. No more than two hoselines can pass through any one single opening of a structure at the same time. Additional openings such as windows, adjacent doors, or windows made into doors are good alternatives.

2. Hoselines shall not be operated in opposition to each other.

3. Permission must be given by the IC before exterior fog streams, or any stream which may reverse the flow-path of venting fire gases, are directed into a fire building if occupants or fire crews are interior.

4. Immediate notification must be given to the IC when a situation is discovered that requires the positioning of an additional hoseline.

5. In order to assure efficient and timely stretching of the fire attack line in multiple story buildings, the services of the first two engine companies should be utilized. The pairing of engine companies will in most cases result in a more rapid and efficient hoseline stretch.

6. To minimize the number of lengths required in multiple floor occupancies and provide for rapid hoseline positioning, consideration should be given to the use of:

- Well-hole stretch
- Utility rope stretch via exterior of building
- Bundle drop stretch
- Standpipe stretches with High-rise bundles

-FLAKING HOSELINES-

FLAKING HOSELINES

Almost as important as shouldering the hose and advancing it to the desired location is the ability to quickly and efficiently flake and set up the hose for operations. Often, it is the lack of good flaking techniques and chasing kinks that leads to a delay in delivering water to the nozzle. It is the responsibility of each member of the engine company to recognize and correct any kinks or when operating in a tight or confined area to properly set up the hose for ease of advancement.

There is an abundance of hose-flaking techniques out there, and the following pages will outline a few common ways that work well with our minuteman hose loads. By using these methods, firefighters will establish a systematic approach to:

- Reducing the occurrence of kinks.
- Reducing the time to place lines into service.
- Developing good “hose management” skills...especially when dealing with a lot of hose in small areas.
- Easier hose advancement into structures.
- Quickly able to identify the amount of working line at hand.

Accordion Forward/Forward Stretch (Photo 4-2) (Photo 4-6)

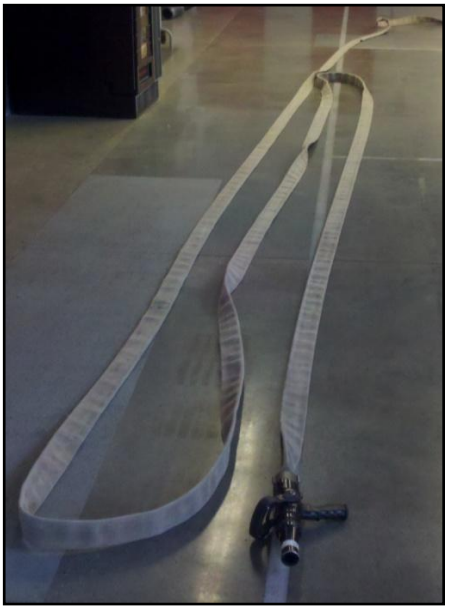


Photo 4-2: The Forward stretch laid out.

This is the fastest and cleanest stretch of those shown. The hose never leaves the nozzle-persons hands and only one run at the target is being made by the nozzle-team.

The forward third of the hose is always the neatest, as it is the managed bit of the load. Therefore, this section of the hose is the easiest to manipulate.

This deployment requires the nozzle to start their stretch by dropping the load away from the structure and stretch toward the target. This stretch can be used in nearly any situation and is simple, fast, and clean.

This is a universal stretch in that it will work from any standard hose-load; it can be deployed from the ground, back of the rig, or shoulder. Most important is that it works in failure as well as perfection. It sets the stage for a rapid advance, as it lays the hose in a manner that the “heel” person can easily determine where to position themselves on the line to continue the stretch efficiently. With the hose on your right shoulder move your right hand and grasp the nozzle, the left hand and grabs roughly the middle bight(s) of the shouldered load. Drop your right shoulder, dumping the shouldered hose onto the ground, while maintaining your grip on the bight and the nozzle. Stretch the line towards the objective.

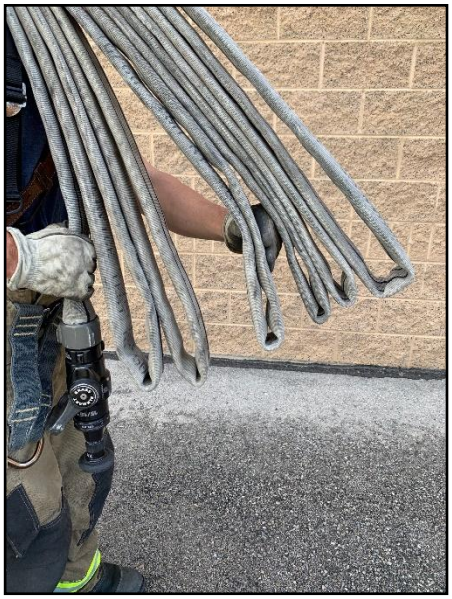


Photo 4-3: Grabbing the middle bight and nozzle of The Forward Stretch.

Ideally, the nozzle person will drop their bundle once they have lined themselves up with the target. If a straight approach is not possible, the nozzle person will drop and drag the hose while advancing using proper angles to prevent the line getting tangled upon approach.

Typically, don’t drop the shouldered hose for an “accordion forward” until you have cornered to lay in straight. As is seen in this photo series, the “accordion forward” is fast, clean, and simple.

Photo 4-4: Dropping the bundle from the shoulder while maintaining the middle bight and nozzle.

Photo 4-5: Forward movement Of the middle bight and nozzle.

Photo 4-6: The Forward Stretch ready to be charged.

“V” Split/ Reverse Stretch (Photo 4-7) (Photo 4-10)

Photo 4-7, 4-8: The reverse Stretch Grab the top and bottom of the bundle.

One of the two options if the line is going to be deployed using an “Accordion Reverse” is the “V” split. By splitting the shouldered bundle and splitting it upon setting it down, the nozzle-person will expose the middle bight making the reverse stretch clean.

While the hose is still on the shoulder split the bights in half, using the same hand pattern as an “Accordion Forward.”

The right hand takes nozzle and the bottom half of the bights, left hand takes top bights. Drop the bundle holding the two sections, and take a few steps towards the target, opening the bundle up.

The middle bight will be exposed via the split. Grab the bight and run it out to the rear, often bringing the bight back forward. Below →

Another option is to grab the two bights adjacent to the middle bight w h i c h

Photo 4-9,4-10: Multiple ways to "backstretch" the v-split.

Is exposed. By pulling those two bights back the distance of travel is shorter. Take your time to get the “V” produced. This stretch is my personal favorite reverse variation. Above →

In cases where the shouldered hose exceeds the nozzle person’s grip, or there is lack of space the “V” split can still be accomplished. In such cases, dump the left-hand section to one side, (often against the wall,) and take several steps forward and away while holding the right-hand section. This will expose the middle bight and keep the hose in order to how it will advance into the objective

COIL and COIL PROP (Photo 4-11) (Photo 4-15)

Photo 4-11,4-12: The coil charged on the ground and against a wall.

This deployment is meant only for confined areas where an accordion stretch is not an option.

This finish is slower and can present a footing issue if left on the ground. In addition, in a reduced visibility environment this stretch has a potential to become a mess if the nozzle-person makes a mistake.

I typically throw a “Coil Prop” by getting the coil set up on a wall. The coil prop clears up the already confined area by getting the coil propped on a wall or handrail while it is being charged. This keeps the walkway a bit clearer. (In addition, the coils can be rolled to move hose, which is a nice option on stairs.) Make sure to have the nozzle orientated towards the Direction of travel.

There are several ways to throw this finish. My method is to set the bundle down, keeping the forward third as neat as possible. Work the flakes a foot or so behind the shank, as this bit of hose is typically kept clean via the grip.

There is no need to clean up the forward or rear bights if they have become out of sequence while setting the bundle down. The bites will clean up when the stretch is thrown and then charged.

Move the nozzle to the knee, the next bight loaded to the left arm, continue loading bights in sequence until the bundle is divided. "Clap your right hand with your left through the narrow loop section, spread both arms away from each other to open the coil, set the coil down or prop it up, and charge the line.

(Yes, the rhyme helps with recall, especially if you are coming to the engine from a truck. Though the first sound in both “nozzle” and “knee” are alike, they do start with different letters. This has no bearing on the stretch.)

Photo 4-13: The coil ready to be charged on the ground.

Photo 4-14: The "Coil-Prop "ready to be charged on Against a wall.

Photo 4-15: The "Coil-Prop charged against a wall.

The above photo shows the line being held in place for a "Coil-Prop." To the left, is a good example of a finished "Coil Prop." Again, make sure the nozzle is going to pay-off the direction of travel.

-ADVANCING THE HANDLINE-

The manner in which a firefighter physically advances the hose line may depend on the conditions encountered. There are several methods that can be used, each with their own advantages.

Hip Grip
(Photo 4-16)

The basic grip for both standing and the ground, this grip allows for the greatest control and flexibility in line use. This is the foundation grip for both 1 ¾ and 2½ hand-lines. No matter if we are standing or kneeling, the technique is the same. Create a “corner” or “shelf” between our hip and the top of our thigh and press the line into the shelf. **The hands never cross and never use pistol grips.** The backhand keeps the line pressed in and down through the hips, usually the back hand is slightly forward of the hip bone. This grip gives the nozzle the greatest control over the line and application of water in addition to controlling the nozzle reaction.

Photo 4-16: The hip grip allows the greatest control and flexibility.

Da’Clamp
(Photo 4-17)

“Da’Clamp” is primarily designed for operations that are stationary, or in a “hit and move” fire attack scenario. This technique is especially useful during 2½” operations where the backup person is not positioned right behind the nozzle. The key is to use the ankle/shin bone to press the line into the ground using body weight. This way the nozzle reaction is absorbed by the ground. This position gives a lot of control and allows the nozzle to be operated free of nozzle reaction. Da’ clamp removes the need of a backup person stationed directly behind the nozzle itself. This frees the “heel” to pull hose, search etc.

Photo 4-17: D' Clamp allows the nozzle reaction to be absorbed by the ground.

Da' Clamp Slide

(Photo 4-18)

A quick way to advance hose while using "da' clamp," the "clamp slide" maintains the same position during movement, taking out reset and adjustment time, pre and post movement The nozzle-person will create a tripod position by planting the back hand on the ground parallel with the lead leg. The nozzle-person steps forward with the "up" leg, swinging their down leg forward, with a pendulum motion. The pendulum action of the leg and hips will push the hose forward. All the while, the lead arm still holding the hose, is pulling back in time with the leg swing. This creates a lever motion and maintains the tension and spacing on the line.

Photo 4-18: Da' Clamp slide is a fast and efficient way to advance the hoseline from Da' Clamp position.

Crooked Lean

(Photo 4-19, 4-20)

The "Crooked Lean" is a position for a nozzle team to employ when the need arises for two-person nozzle work with either hand-line. The crooked lean works while kneeling or standing. In addition, it gives the nozzle team a way to advance the hose while flowing water as well as flowing water for extended periods of time without moving. The position's use for a "hit and move fire" should not be overlooked. Relying on mechanical advantage, it allows the nozzle team control and the ability to move quickly and without undo fatigue. The nozzle reaction is being absorbed through the skeleton of the team and into the ground. The heel person is angled forward with their shoulder, (or arm in the case of a 1¾", pressing into the nozzle-person's back. The point of contact for the heel's shoulder is where the nozzle-person's bottle and shoulder meet. The nozzle should again, be leaning back into the "heel."

The "Crooked Lean" can be used for extended water application, a "hit and move" fire, or for "pushing" the nozzle toward the objective while flowing. The position has the "heel" positioned directly behind the nozzle.

Photo 4-19: The Crooked Lean is used to advance the hoseline while flowing. (Push)

Photo 4-20: The Crooked Lean is critical to moving while flowing in 2 1/2" operations.

Knee Walk

(Photo 4-21)

The Knee Walk is a Hip Grip that's moving. It's a movement to use when conditions require the Nozzle Firefighter to flow and move by themselves. It's the Plan A in most 1 ¾" push environments or spaces that are too narrow to fit our team's profile (narrow doorways/hallways in old buildings or a house filled with junk.) When the Knee Walk is used, it frees up the heel to position at friction points where they can assist with the movement of the hoseline. The Knee Walk also gives the Nozzle Firefighter the ability the flow while going up or down stairs and over stuff.

Photo 4-21: The Knee Walk can be used to flow up or down stairs.

Comella

(Photo 4-22)

The Comella lock named after Jay Comella of Oakland FD is a simple but highly effective nozzle firefighter stance. The Comella lock is simple and easy to learn and highly effective with a variety of hand lines. It is particularly effective with high flow low pressure hand lines with a propensity to have nozzle whip. This nozzle stance is almost a mirror image of the nozzle forward hip grip. The nozzle side knee is raised and the opposite knee is down, the hose is cradled on the forearms and in the palms of the hands. The force from the nozzle reaction is driven into the pelvis legs and the hose behind the nozzle Firefighter.

Photo 4-22: The force from the nozzle reaction is driven into the pelvis legs and the hose behind the nozzle Firefighter.

Here are some key points to keep in mind when attempting to improve your Comella Lock. As with any nozzle position, more hose straight behind you on the ground will drastically reduce the feeling of nozzle reaction. Use your rib cage and the nozzle side elbow to lock the hose against your Pelvis, both hands under the hose and point your index fingers towards the nozzle. Let the nozzle reaction push your body weight back onto your heel and keep your heel right in the center of your buttocks. You must keep a live toe. This means the toe of your boot is curled. Anticipate discomfort from the steel toe of your boot digging into your foot this is normal to attain the maximum benefit from this body position. You must consciously be directing the nozzle reaction into the ground under you and behind you.

- OPERATING THE NOZZLE-

Once the attack line is charged and the door is opened, entrance is made into the fire occupancy. After making the initial entrance into the structure the fire attack team should move to either side of the doorway and try not to block the opening.
This action is taken to remove these firefighters from the flue like conditions that develop when the entrance door is opened. This condition becomes even more pronounced when the fire has not vented via windows and the entrance door is the first opening into the fire area. If the actual fire location is an interior room the Nozzle Firefighter must recognize this and continue to advance to the fire room and cooling the environment if needed.

While operating the nozzle the firefighter should hold the nozzle at arm's length, out in front. This position allows the firefighter to redirect the nozzle quickly by simply bending the several feet of hose in the desired direction. Operation of the nozzle in an inverted "U" or "side to side" pattern while directing the stream into the fire area pushes the heat, fire and steam ahead of the fire attack team. As progress is made, the stream is lowered and directed toward the main body of fire.

The following four nozzle handling techniques for directing the stream during fire attack is important for the Nozzle Firefighter to know and understand.

1. If roll-over fire is encountered the nozzle can be used to cool and push the fire gases back toward the fire area by directing it upward and toward the ceiling using a rapid side to side motion. Minimum steam generation at the lower level of the passage or hallway is desirable for rapid advance, therefore impacting side walls with streams should be minimized at lower levels. The steam generated initially at the upper levels will be pushed ahead with the heat and fire. Maintaining an adequate rate of flow will condense the steam and cool the fire gases ahead of the stream and will carry away the lower wall heat in the run-off. The tactic of "Penciling", quick bursts of water into the overhead to cool it down, is not considered an appropriate tactic and should not be used or encouraged. If the overhead is so hot to the point where flashover could occur, rapid and aggressive cooling for several seconds is the only method to prevent the flashover from occurring.

2. If heavy fire conditions in multiple rooms are encountered the Nozzle Firefighter should operate the stream as the advance is made. The stream should be directed forward in an inverted “U”, striking the ceiling, walls and occasionally the floor, deflecting the stream toward the fire area. The deflected water will:

   - Cover a greater area
   - Brake up and cool superheated combustible gasses at ceiling level.
   - Provide greater heat absorption by breaking up on impact and exposing more water surface to the heat.
   - Prevent “rollover”.
   - Prevent development of flashover by cooling the upper level of the fire area.

   As the attack line is advanced into the fire, the floor is also being swept with the stream. This action cools hot or burning debris located on the floor, removes other potentially dangerous objects such as broken glass from the path of the advancing firefighters. A change in the sound of the stream as it sweeps the floor could indicate the presence of an opening such as a hole or stairway.

3. If rooms to either side of a hallway must be extinguished while advancing toward the main area of involvement, the stream should be operated well ahead prior to turning to operate into the side rooms. This action is necessary in order to push back the advancing fire sufficiently to allow the nozzle team to safely reposition and operate into the side rooms.

4. When storage, furniture, partitions, vehicles, or other obstructions block or prevent the stream from hitting the main body of the fire, use the ceiling, walls or other stable stationary objects to deflect the water onto the fire.

Water Supply

5

Notes

- WATER SUPPLY -

Water is the medium that is most frequently used to fight structural fires, vehicle fires, wildland fires and many other types of fire emergencies. Many of our tactics are based on the immediate water supply at hand. Most fires can be controlled with the available water carried in the booster tank. However, for redundancy and in those cases where supplement water is required for prolonged operations the engine company relies on the municipal water system.

Every engine in Draper Fire is equipped with a 750-gallon booster tank. This portable water supply allows the engine company the flexibility to complete their primary mission rapid suppression of the fire. Based on the size of the fire and the conditions on arrival the officer will make a size-up and decide on how and if the on-board water supply will be used or not.

Weather the first engine lays its own water supply (Lay-in wet or lay-in dry) as it approaches the fire building, or another engine lays that supply line for them, the engine company that is attacking the fire will have hydrant water relatively quickly. This doesn't eliminate the need to use the on-board booster tank to supply the initial fire attack, but rather limits the amount of water that will have to be used while waiting for the hydrant water to arrive.

When the need to use a hydrant arises, there are three basic supply line lays that Draper Fire uses. Depending on arrival order, direction of travel, occupancy type and anticipated water needs, the Company Officer may decide to use one of these supply lines lays: Forward (Lay-In), Reverse (Lay-out), or Split lay. In addition to the direction of the lay, the choice of keeping the line dry or wet is also an option.

The first arriving engine company may elect to pass up a water supply and initiate the fire attack off the booster tank and assign the supply line to the second due engine; or may elect to lay-in dry or lay-in wet. Whatever decision the first-in Company Officer chooses to select, they MUST announce over the radio their water supply intentions so that the second due engine can adjust their strategies accordantly.

-FIRE HYDRANTS-

Fire hydrants come in many different sizes and shapes, and vary in design but these hydrants are the easiest source of water for an engine company. The primary hydrants that an engine company should expect to find are the Dry-Barrel hydrants. There are many different outlet configurations that will be encountered. The standard hydrant will have one 4 ½" (steamer) outlet and two 2 ½" outlets. In commercial or high occupancy areas, you may encounter hydrants with two steamers. The three basic components associated with the hydrant: Barrel, Discharge outlets and Stem (shut off valve).

There are a few different styles of hydrants found within the Draper Fire jurisdiction for firefighting use. The type, size and spacing are determined by the water districts they reside in. All outlets have National Standard Threads (NST) per NFPA. The diameter of the outlets is 2 ½" or 4 ½".

DRY-BARREL

As the name implies, when the stem valve is closed, the barrel from the top of the hydrant, down to the water main is empty. The main valve is located below the frost line underground, which prevents water from entering the barrel. Normally, the hydrant barrel from the top of the stem down to the main valve is empty of water. It is important to remember, when a dry-barrel hydrant is charged no additional lines may be added to the other outlets unless the hydrant is shut down or a shut off valve is added prior to charging.

When the stem valve is opened, water is supplied to ALL outlets at the same time. To accommodate additional water supply needs, multi-outlet dry barrel hydrants must have a 2 1/2" hydrant gate-valve attached to an unused outlet at the onset of any hydrant operation.

Following are some of the most common dry barrel hydrants found in the areas served by Draper Fire.

Photo 5-1: A typical dry-barrel hydrant with one steamer port and two 2 ½" ports.

Photo 5-2: Cut away view of dry barrel hydrant. Note the Stem Valve running down the center of the barrel.

Standard Dry Barrel
(Photo 5-1, 5-2)

The most common dry–barrel hydrant found within the Draper Fire response area. Comprised with two 2 ½" outlets and one steamer outlet. The current city code allows for the following make and manufacture of hydrants, although older hydrants may be found in the city, the functions are similar: Mueller Centurion; Waterous Pacer; or Kennedy Guardian.

Mueller Centurion

Waterous Pacer

Kennedy Guardian

Double 2 ½"
(Photo 5-3)

A dry-barrel hydrant with two 2½" outlets. These outlets are feed by a 4" Main, expected flows are less than 600gpm. Below is a link to the GIS map with the locations of the hydrants in the city.

https://Draper.maps.arcgis.com/apps/webappviewer/ index.html?id=0f3fad3d054348288032acbbcedbdd58

Photo 5-3: A typical Double 2½" with two 2 ½" ports.

Private Hydrant Systems
(Photo 5-4, 5-5)

There are a few locations throughout the city that contain privately owned hydrants systems. The maintenance and repair of these systems is the responsibility of the HOA or business owner/management. The Draper City water department may flow test these private hydrant systems if staffing and time allow.

Photo 5-4: The Heather Ridge neighborhood has a privately owned hydrant system.

Photo 5-5: The University Place parking garage and its interior hydrants are privately owned.

STEM VALVE ROTATION

The nationally recognized direction to open hydrant stem valves is counter-clockwise (“Open-Left”). All water districts and municipalities that surround the City of Draper follow these standards.

BASIC HYDRANT FLOWS

The amount of water available to an engine company through a fire hydrant may vary based on many factors, including main size, pressure in the system, and the number of hydrants being operated off the same main at the same time. While there are many factors, sum of which are out of the control of the engine company, there are some basic flows that the engine company can rely on.

- A single 5-inch line may not flow all of the available water from a hydrant and/or water main.
- Provide one 5-inch hose line for every 1000 gpm to be delivered.
- Draper Fire engines typically realize flows ranging from 500 gpm to 1000 gpm over the pump rating (1500 gpm).
- A 2.5” discharge delivers 1500 gpm @ 80 psi.
- A 2.5” hydrant outlet will deliver approximately 80% of the flow of a 4.5” outlet.
- A 4.5” hydrant outlet with a flow pressure of 15 psi = 2100 gpm

HYDRANT BUCKET/BAG (PHOTO 5-6)

The hydrant bucket or bag is used to store and carry all of the essential tools and adapters to complete a hydrant hook-up. Each Draper Fire engine is issued a hydrant bucket/bag, tools and appliances. The hydrant bucket/bag is stowed in the rear compartment. Depending on the arrival order of the engine company and the type of supply line lead that will be performed either the 1st due or 2nd due engine will leave the bucket/bag and its contents at the hydrant.

The contents of the hydrant bucket/bag are:

Screw Handle Hydrant Wrench:

Used for opening and closing the hydrant on the bonnet nut. Has double claw sides for use on coupling lugs.

5" Storz x 2.5" Female:

Enables the connection of a 5-inch supply line into a 2.5" hydrant outlet, when threaded onto the adapter above.

2.5" and Storz Spanner Wrenches:

Used to tightening and loosing hose couplings and valves.

2- 2.5" Hydrant Gate Valve:

Attached to the 2.5" outlets when additional GPM is required.

2.5" Double-Female:

Connected to a hydrant outlet when a 3- inch supply line is used.

Rubber Mallet:
Used for loosing stuck hydrant caps and hoseline couplings. Also, can be used for chasing Cops away from the fire scene.

Photo 5-6: A typical hydrant bucket and its contents.

-FORWARD LAY-

A Forward Lay is a supply line evolution that starts with the laying of a hose-line from a hydrant / water source, and proceeds to the fire (*hydrant- to-fire*). The forward lay operation is used when the engine stops at a hydrant, “Lassoes” the LDH around the hydrant and drops the supply line toward the fire building. Depending on the type of lead the officer selects, the Back-Up firefighter can be left at the hydrant to complete the connection.

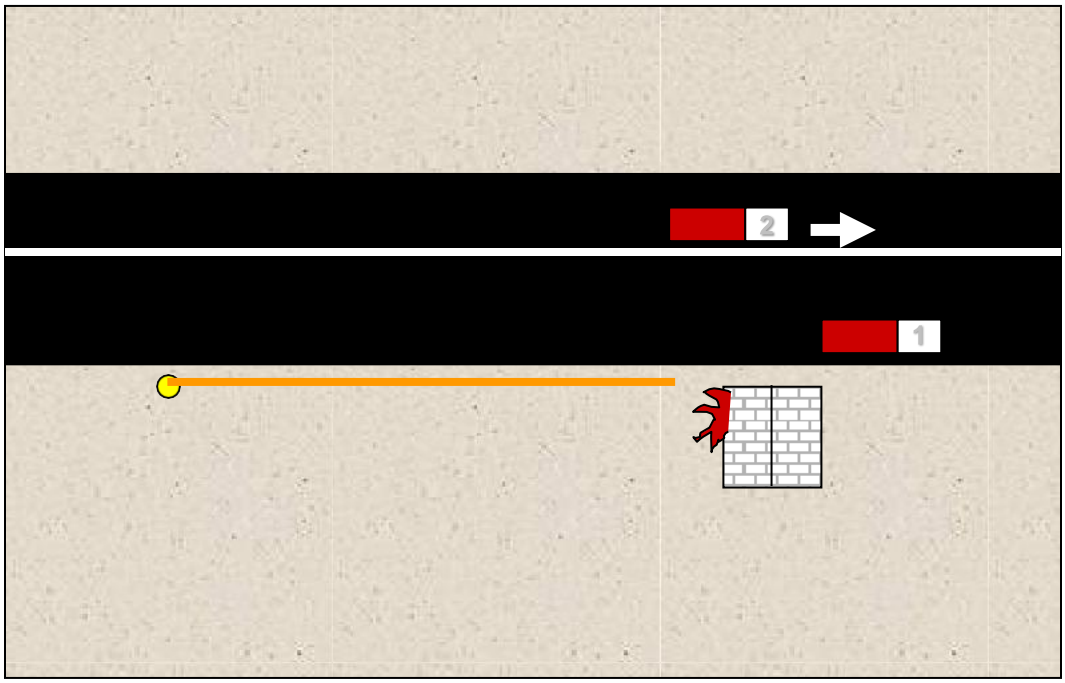


***Figure 5-7: Laying-in wet*. 2nd due engine laying-in from the hydrant to the 1st due engine.**

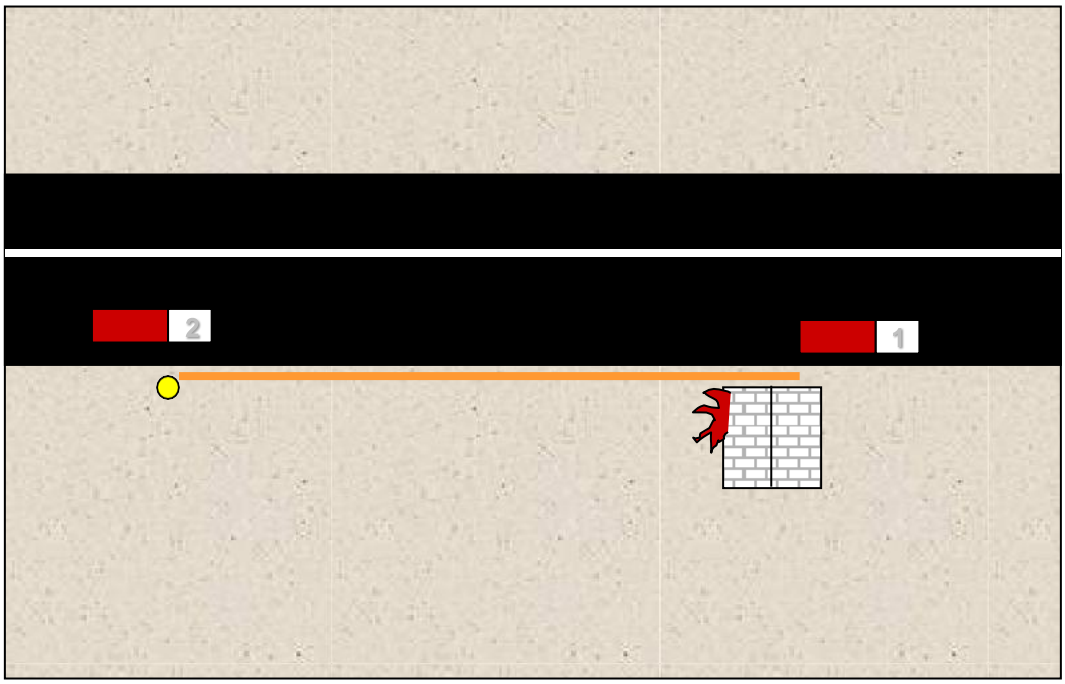


Figure 5-8: Laying- in dry or wet. 1st due engine lays in wet or dry to address. 2nd due engine supports supply if needed.

This evolution is typically done by either an engine company providing its own water supply, or by one company supplying another company already on scene.

There are two types of operational modes regarding LDH leads:

The "Wet" Lead:

The back-up firefighter will remain at the hydrant and charge the line when the command to do so is received.

The "Dry" Lead:

The Tailboard firefighter anchors the hose, leaves the hydrant bucket, and proceeds to the fire with his/her crew. Other personnel will be assigned to charge the hydrant.

-REVERSE LAY-

The reverse lay option may be employed by either the first due engine or the second due engine and occurs when the engine arrives at the fire building first and then proceeds to the hydrant location. In some cases, this action may be advantageous for the fire ground operations because it places the engine at the source of the water and the engine can supplement the pressure from the hydrant to the engine that ends in front of the fire. This evolution can be further subdivided into either a:

Supply evolution:

LDH is connected between the suction-side of the pump, and the hydrant.

Attack evolution:

LDH is connected between the discharge-side of the pump, and an appliance or master stream.

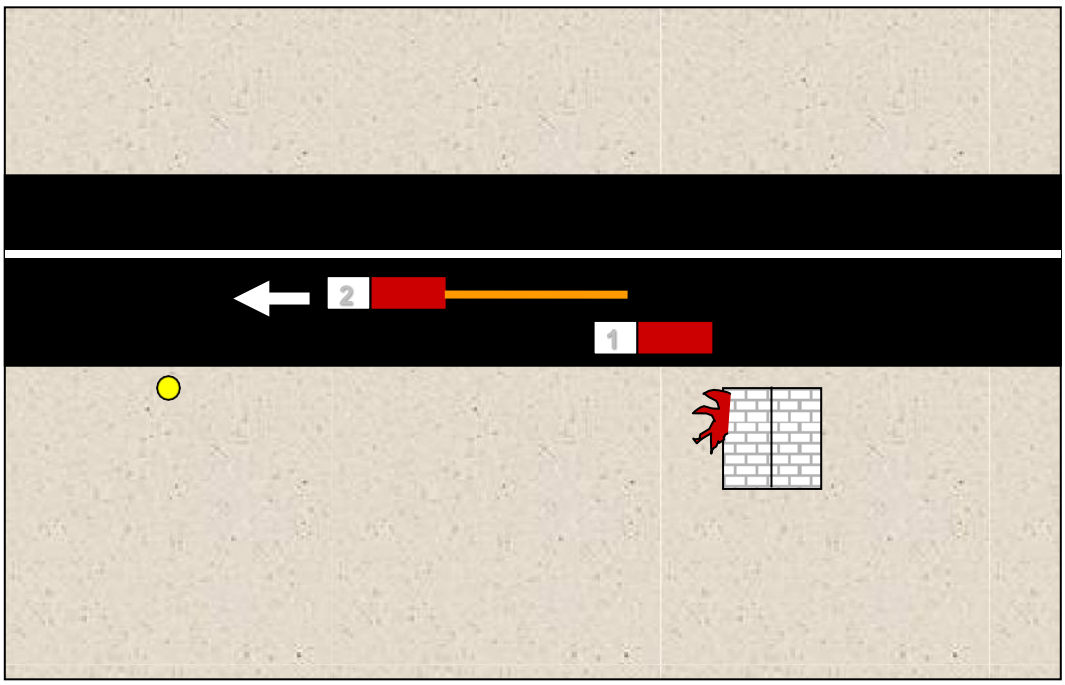


***Figure 5-9: Reverse Lay*. The 2nd due engine laying-out from the 1st due engine to the hydrant.**

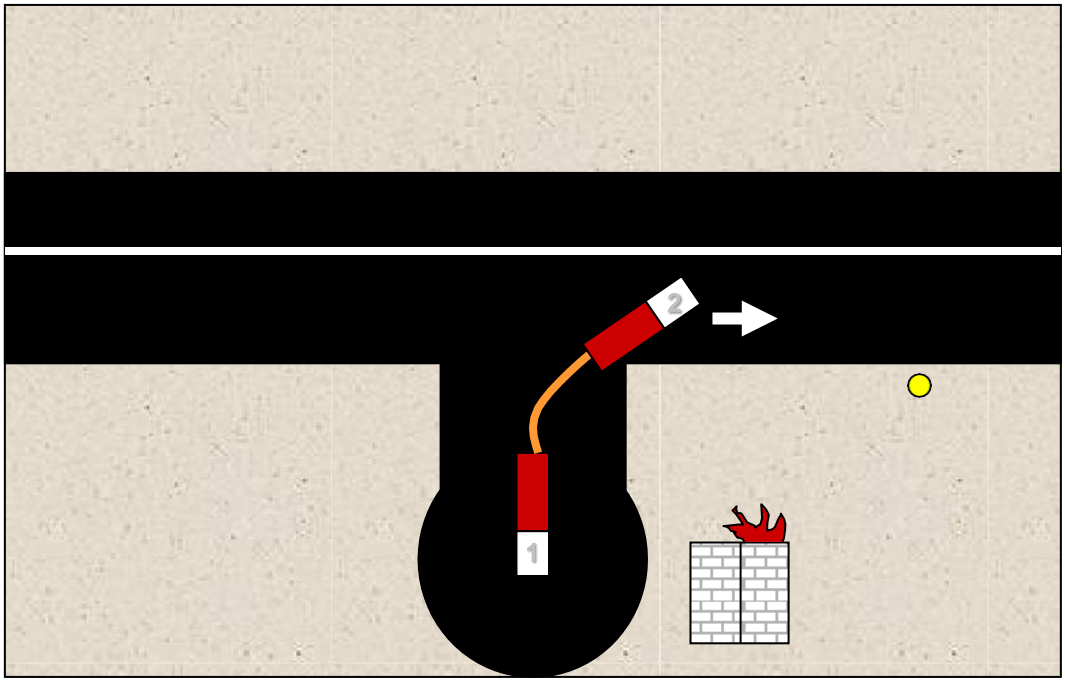


***Figure* 5-10: down to the 1st due and laying-out to the hydrant from the 1st due engine.**

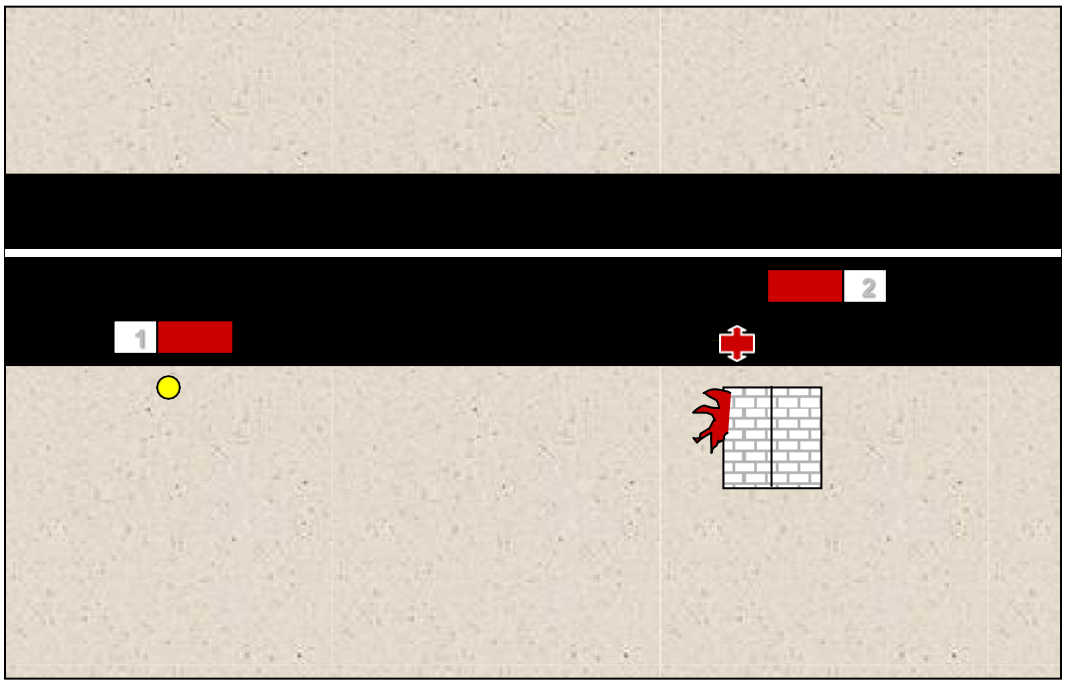


Figure 5-11: Dropping equipment and leading out. 1st due engine drops manifold and hose and leads to hydrant. 2nd due supports as needed.

- SPLIT LAY -

The third option for engine companies to lay hose is the Split Lay. In this operation the first due engine may have to place their apparatus in a position where there is no water. Examples of this may include operating in a cul-de-sac or entering a limited access apartment complex or commercial structure where the water supply is located on the main thoroughfare. If the company officer chooses this tactic, they will drop their DH at the entrance to the area that they will be operating. If the first due engine MUST transmit their intention to start a split lay.

The second due engine will complete the split. Depending on the direction of travel in relation to the split, they can either lay-out from the split to the hydrant or lay-in from the hydrant to the split.

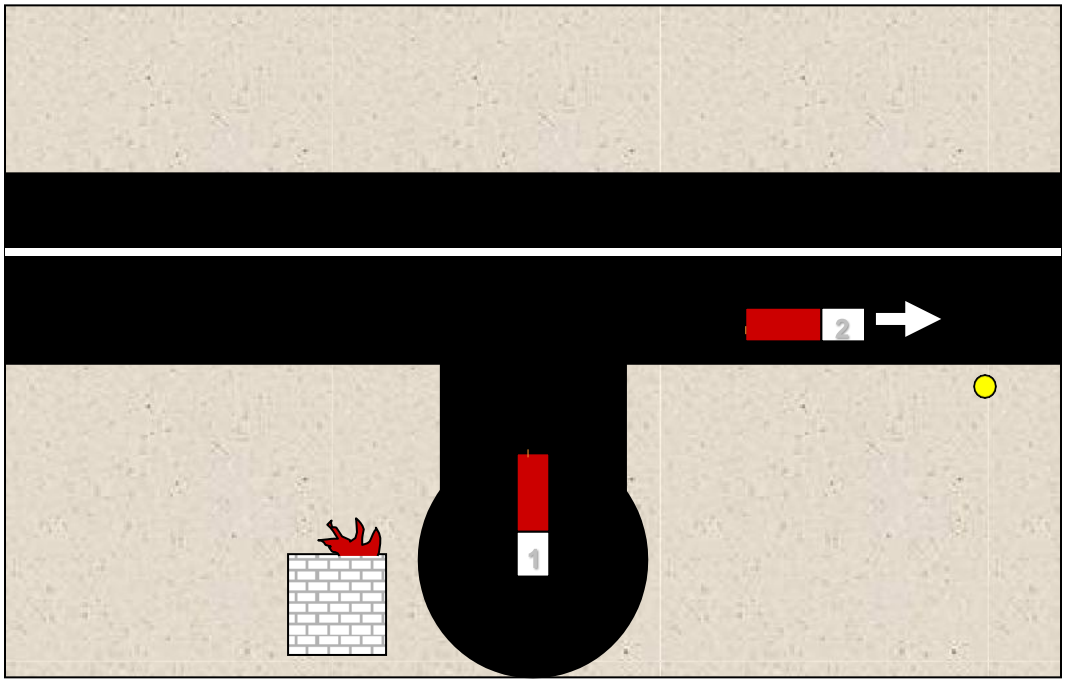


***Figure 5-12: Completing a split lead in a cul-de-sac operation*. 2nd due engine laying-out to the hydrant from the 1st due engine.**

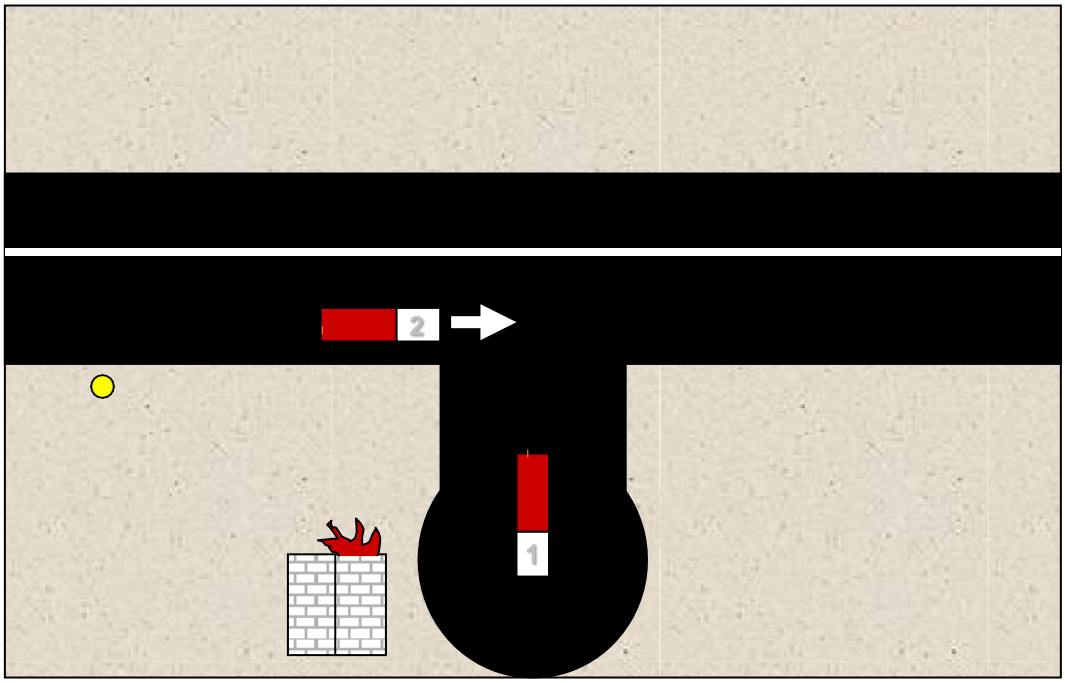


***Figure 5-13: Completing a split lead in a cul-de-sac operation*. 2nd due engine laying-in from the hydrant to the 1st due engine.**

- HIGH-FLOW HYDRANT OPERATIONS -

There are three basic tactics to employ when getting the most water from a distribution system. They are listed below in order of least preferred to best preferred.

- Multiple supply lines from a single hydrant. **(Photo *5*-14)**
- Pumping the hydrant with the 2nd or 3rd due engine suppling the attack pumper. **(Photo *5*-15)**
- Multiple supply lines from different hydrants sharing the same water main. **(Photo *5*-16)**
- Multiple supply lines from different hydrants not Sharing the same water main. **(Photo *5*-17)**

Photo *5*-14: Multiple supply lines From a single hydrant.

Photo *5*-15: Pumping the hydrant with the 2nd or 3rd due engine suppling the attack pumper.

Photo *5*-16: Multiple supply lines from different hydrants sharing the same water main.

Photo *5*-17: Multiple supply lines from different hydrants not sharing the same water main.

RELAY-PUMPING
(Photo 5-18)

Using two or more pumpers to move water over a long distance by operating them in series; water discharged from one pumper flows through hoses to the inlet of the next pumper, and so on. Also known as Relay Pumping.

During some incidents, the water source may be found remote from the fire scene In these instances, relay pumping may have to be employed.

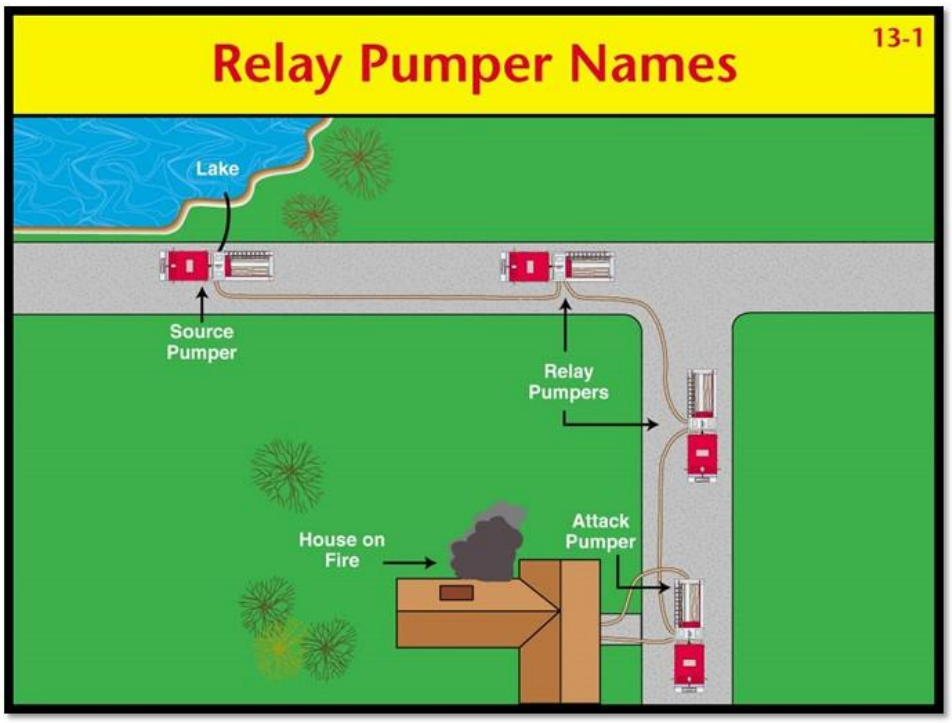
Photo 5-18: Relay pumping over long distances requires coordination.

A relay pumping operation consists of a pumper positioned at the water supply source that is used to pump water under pressure through one or more supply lines to another pumper connected further down the supply line(s). This pumper boosts the pressure to supply the next pumper and so on until water reaches the attack pumper. In order to be effective, relay operations require pre-planning, training, and coordinating of all participants.

- **Water supply pumper** - Pumper that takes water from a hydrant or static source and pumps it under pressure to the next apparatus in the relay pumping operation. Water supply pumpers should be the apparatus with the largest pumping capacity. Some jurisdictions refer to water supply pumpers as source pumpers.

- **Relay pumper** - Pumper or pumpers connected within the relay that receive water from the source pumper or another relay pumper, raises the pressure, and then supplies water to the next apparatus. This pumper may be of smaller capacity due to its ability to use the acquired energy of previous pumpers in the relay.

- **Fire attack pumper** - Pumping apparatus located at the fire scene that receives water from the relay and is responsible for supplying the attack lines and appliances required for fire suppression.
  Some fire departments, especially those that have occasion to make many



Draper Fire Department uses the Constant Pressure Relay method for establishing hydraulic pressures and distances during relay operations. For more specific information see the current **APPARATUS DRIVER / OPERATOR HYDRAULIC CALCULATION STANDARDS** in Target Solutions.

Constant Pressure Relay (Maximum Volume)

Implementing a constant pressure relay operation

Step 1, Position Attack Pumper
Step 2, Position Source Pumper at "Key" hydrant
Step 3, Lay out hose and place Relay Pumpers at 750 foot intervals
Step 4, All pumpers except source pumper open a discharge to exhaust air from the lines
Step 5, Source pumper throttles up to 175 psi
Step 6, 1st Relay pumper closes unused discharge once a steady stream of water flows through it, then throttles up to 175 psi.
- All successive Relay pumpers follow the same procedure
Step 7, All Driver/Operators set their intake relief valves
Step 8, Attack pumper adjusts PDP to supply attack lines.
- Maintain water flow during temporary shutdowns by using one or more discharges as waste or dump lines

Maximum volume at 750 feet by hose layout

	One 2 1/2	One 3	One 4	One 5	Two 2 1/2's	One 2 1/2 & one 3	Two 3's
Max flow	321gpm	508 gpm	1017 gpm	1607 gpm	643 gpm	830 gpm	1017 gpm

Maximum volume relay pump pressure

Source and Relay pumpers - Maintain 175 psi
Attack Pumper - adjust PDP as needed making sure to dump excess pressure
** PDP accounts for 20 psi residual pressure for the next pumper in the relay*

Key positions in a relay operation

Source Pumper - Positioned at the "Key" hydrant
Relay Pumper/Pumpers - Spaced evenly throughout the relay at intervals of 750 feet
Attack Pumper - Placed at a forward "Key" attack position

1 mile = 5280 Feet

Standpipe Operations

6

Notes

- STANDPIPE OPERATIONS -

Of the many types of firefighting tactics that an Engine Company may face, stretching and advancing hose lines from the standpipe can be a taxing and complicated operation. The Engine Company can either stretch a hoseline from the apparatus into the building for fire attack or they can choose to stretch the attack line from the building standpipe system. Depending on the era that a building was built, and the regulations at the time, standpipe systems will be found in multifamily residential buildings over three floors in height, and commercial or residential low rise and high-rise buildings. These standpipes are usually located in enclosed stairwells but can be positioned in the public hallway or on the exterior of the building alongside fire escapes. When fires occur in buildings equipped with standpipe systems, Engine Companies are responsible for completing three critical tasks:

- Transporting hose, nozzles, fittings, and other tools to the hose outlet valve selected for use.
- Stretching and advancing a hose line to control and extinguish the fire.
- Supplying or augmenting the standpipe system to ensure an adequate volume of water at proper pressure.
- Also located in Big Box Structures

- STANDPIPE SYSTEMS-

Standpipe systems are categorized according to the size (diameter) of the hose outlets and as being either "wet" or "dry." Wet standpipe systems contain water in the riser at all times. The water is supplied by municipal main, gravity tank, pressure tank, or a combination of these sources. In many cases, manual or automatic fire pumps are used in conjunction with municipal water supplies to boost pressures on the upper floors of tall buildings. Standpipe systems may also be "dry." Dry systems have no automatic source of supply and depend solely on fire department pumpers to provide the system demand. NFPA 14, Standard for the Installation of Standpipe and Hose Systems (1993 edition), establishes three classes of standpipe systems:

Class I Standpipe:
(Photo 6-1)

- 2 ½" outlets
- For fire department use only

Photo: 6-1: A Class-I standpipe will only have 2 ½" outlets and is for Fire Department use only.

Class II Standpipe:
(Photo 6-2)

- 1 ½" outlet with 1 ½" hose
- For occupant use

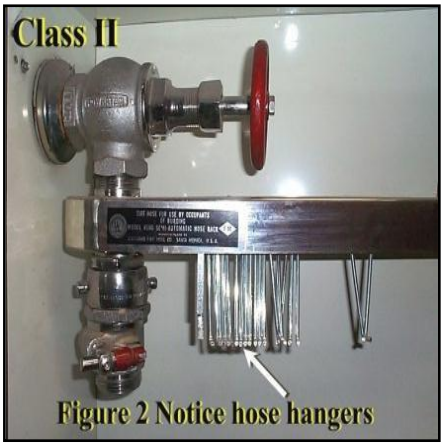


Photo: 6-2: A Class-II standpipe will have 1 ½" outlets and 1 ½" hose and is for occupant use.

Class III Standpipe:
(Photo 6-3)

- 2½” outlet and 1½” outlet or
- 2½” outlets reduced to 1 ½” with a removable reducer for occupant and firefighter use.
- Usually, 1 ½” "occupant-use" hose is provided

***Photo:6-3**: A Class-III standpipe is for Fire Department or occupant use.*

Combined Sprinkler / Standpipe System

Incorporates a water supply for automatic sprinklers with a Class III standpipe system (in some cases the occupant hose connections are not required when automatic sprinklers are provided.)

Until the 1970s, many building codes required either separate Class I and Class II standpipes, or a Class III system. Many of the older buildings utilize Class II standpipe outlets (for occupant use) to be supplied by the building's domestic water system, and permit dry standpipes to meet Class I requirements. The dry standpipe risers are charged with water when hose lines are connected to the fire department connection (FDC). Some buildings utilize a built-in water supply for the Class I or Class III standpipes, which generally required one or more fire pumps to boost the pressure from the public water system. Engine companies should never attempt to use the unlined, linen hose provided with standpipe systems. It often is old and improperly maintained and may fail under fire department operating pressures. An exception to this rule applies to a ladder or rescue company operating remotely from an engine company while performing searches. Stretching and operating occupant-use hose would be justified in an attempt to save civilian and firefighter lives.

Since the 1970s, the trend has been to require automatic sprinkler systems in almost all new commercial buildings. Most new systems are installed as combined sprinkler/standpipe systems, and some older Class I or Class III standpipe systems have been converted to combined systems to supply water for retrofit automatic sprinkler systems.

Combined sprinkler/standpipe systems generally require a fire pump to increase the pressure coming in from the public water system, in order to deliver adequate pressure at the upper levels of the building. These pumps may be electrically driven or powered by internal combustion (generally diesel) engines. Some codes require a backup water supply system on the premises, in case the public water system is out of service due to an earthquake, or other disruption. Virtually all standpipe, sprinkler, or

Combined systems require fire department connections so that the water supply can be augmented by fire department engine companies. In most newer buildings, a single set of connections supplies water for all of the fire protection systems in the building, while older buildings may have a multitude of different connections that each supply water to a different area, stairwell, or system within the building. Therefore, it is important for firefighters to have information about the water supply and connections for each specific building. This information should be gathered during pre-fire planning.

Locations often equipped with standpipe systems:

- High-rise residential and office buildings
- Large-area buildings such as hospitals, terminals, warehouses
- Manufacturing facilities, and industrial buildings
- Enclosed shopping malls
- Theaters, stadiums, and arenas
- Above- and below-grade parking garages
- Bridges and tunnels

Prior to 1993, a 65-PSI residual pressure was all that was required at the topmost standpipe outlet. The riser had to provide 500 GPM at this pressure. Any additional risers in the building had to flow 250 GPM each. A 100-foot 1 ¾" Hotel Pack (using 10 feet of 3" as a leader line) requires 110 PSI to flow 150 GPM with a75-PSI nozzle pressure. As you can see, this pressure will not provide an adequate fire stream for 1 ¾" hoselines. It is imperative that companies become familiar with their districts and know which high-rise buildings fall under this old standard, in order to be properly equipped with the right diameter hose line.

The present NFPA Standard requires a minimum PSI of 100 at the top outlet. This pressure can provide effective fire streams for both 1 ¾" and 2 ½" hose-packs. However, keep in mind that these minimum standards are based on ideal situations where the system has been properly maintained and 100% dependable. A scenario we must realize does not exist in many buildings.

- STANDPIPE HOSE AND EQUIPMENT -

High-rise Bundles
(Photo 6-4)

The high-rise bundles will consist of four 50 foot 2 ½" inch hose packed in a Denver load configuration with straps.

For residential occupancies and hotels, the Corona Load can be attached to the high-rise shutoff nozzle, for overhaul and if fire conditions allow. **(Photo 6-5, 6-6)**

Photo 6-4: 2 ½" High-rise Bundles.

High-rise Kit
(Photo 6-7)

The high-rise bag is a nylon bag that contains support hose tools and equipment to support standpipe operations. The minimum equipment included in the bag includes: See VTA High Rise Policy

Photo 6-7: High-rise bag and its Contents.

Photos 6-5, 6-6: 1-3/4" Corona bundle connected to the high rise-shutoff

2 ½" High-rise Nozzle
(Photo 6-8)

The shut-off attached to one of the high-rise packs is a 2 ½" ball style shut-off. Built into the shutoff is a 2 ½" to 1 ½" reducer. The reducer allows the 1 1/8" smooth bore tip to be attached. Together, these components assembled will make up the high-rise nozzle.

A secondary feature that the shut-off provides to the Engine Company is the ability to turn off the water, disconnect the tip and extend or add additional hose to the hose stretch at the nozzle.

Photo 6-8: *High-rise ball shut off.*

2 ½" Gate Valve
(Photo 6-11)

The Gate Valve allows the firefighter located at the standpipe outlet to have better control over the discharge pressure. It also provides for redundancy if problems arise with the standpipe outlet valve or PRD/PRV.

***Photo 6-11**: Gate Valve attached to standpipe outlet valve, before the line gauge.*

-OPERATING FROM STANDPIPE SYSTEMS-

Transporting the hose bundles, standpipe kit, and other tools necessary to properly hook up to a floor outlet and place a handline in service is a critical task required of Engine Companies. In low-rise buildings, elevators should not be used by fire attack crews necessitating that hose and other equipment be carried up the stairs. Crews may use the elevators in buildings over six stories, provided that an Elevator Operator is in place and the crews exit the elevator a minimum of two floors below the fire floor.

How each Engine Company divides the hose and equipment to be carried into the building by the firefighters assigned to the crew is ultimately determined by the Company Officer. Each Engine Company assigned to fire attack will bring all four 2 ½" hose bundles, high-rise kit, and the forcible entry tools. This manual requires that 2 ½" hose and smooth-bore nozzles are to be used when operating off standpipes in both commercial and residential low-rise and high-rise buildings. The main reason for this is the limited pressure available in wet standpipe systems built prior to 1993 (65psi) and the extinguishing capability of 2 ½" hose. The 1 ¾" Corona bundle may be attached to the 2 1/2" shutoff in certain situations when fighting fires in residential buildings. The decision to use the Corona bundle should be made only when the Company Officer feels the fire conditions (no fire in the public hallway); stairwell size and configuration, and mobility needed will quickly extinguish a fire contained to one unit.

The final critical engine company task is to place a hoseline in service to confine and extinguish the fire. Placing this hoseline in service, however, requires careful consideration of a few important factors:

- The location of the fire within the building (what floor and what occupancy is it in?)
- The distance between the fire and the nearest standpipe outlet
- Availability of an adequate number of firefighters to place the first hoseline in service promptly (two companies)

Once the location of the fire has been determined, the appropriate hose outlet can be selected. The goal is to use one in the stairway closest to the fire to minimize the length of the stretch. All primary standpipe hookups must be made on the floor below the fire. The first Officer to reach the fire floor should report information on the location of the fire and conditions in the public hallway on the fire floor.

An important point to bear in mind is that if additional hoselines are needed, they may have to connect to a hose outlet two floors below the fire or to hose outlets in more distant stairways. Engine Companies responsible for the second and third lines should anticipate this fact and should add additional lengths of hose to their stretch. Under no circumstances should a hookup be made to a hose outlet that does not afford the fire attack Engine Company protection from heat and smoke, such as in a corridor or hallway.

After the hookup point is chosen, four important operations must be performed at the hose outlet valve before the hose can be attached:

1. Always make sure the hose outlet valve is closed before attempting to remove the outlet cap. In the case of dry standpipe systems, hose outlet valves may be in the open position on other floors, and firefighters will have to be assigned to shut these valves so as not to rob pressure from the system.

2. Remove or adjust the pressure-regulating device if present. PRDs routinely are installed on standpipe outlets to reduce, restrict, or otherwise control pressures. It is possible to find PRD's in buildings that are only six or eight stories in height. Some types of PRD's can be removed, but others are permanently affixed and cannot be removed--at least not in any reasonable amount of time. Non-removable PRD's must be adjusted to the fully open position. The method by which this is accomplished varies by manufacturer. It is important to recognize that special tools and training may be required to adjust these devices. Various adjustment tools can be located in the high-rise kit. A third type of PRD exists, and it is the most dangerous. It cannot be removed and is not field-adjustable. The presence of permanently affixed, nonadjustable PRD's should be noted during pre-fire planning inspections, and this information must be disseminated to all affected fire companies. For more information on PRD’s see the Training Resources page at the beginning of this manual.

3. Flush the system to remove debris that could clog or damage the nozzle. The standpipe system must be flushed thoroughly through the open hose outlet valve. Since NFPA 14 gives no requirements for installing screens or strainers within standpipe systems, garbage and debris often accumulate in the riser and piping and must be flushed so the nozzle does not clog or disrupt the stream of the first hoseline. Flushing the system in this manner also provides the engine company with assurance that the outlet valve is properly functional and will allow for pressure adjustments as required.

4. Attach the gate valve to better control nozzle pressure. Once the system has been flushed, the in-line gauge can be attached and the hose hooked up, ready to be charged on orders from the engine company officer. Pressure adjustments then are made by monitoring the in-line gauge and turning the control wheel at the outlet with the nozzle fully open and flowing.

A question often arises as to when the hoseline should be charged. In commercial buildings this manual requires that the line should always be charged within the confines of the stairway. A bedroom or kitchen fire in a residential building may allow the Engine Company to stretch the line dry to the apartment door. In those situations when the fire is more developed (especially if the wind is a factor), or the apartment door is open creating unsafe heat and smoke conditions in the public hallway, then charging the line in the stairway is the only safe option. If any doubt exists, charge the line in the stairway.

- STANDPIPE ASSIGNMENTS-

FIRST ARRIVING ENGINE ON FIRST-ALARM

I. First arriving Engine on first-alarm

A. The Company Officer should establish Offensive/Fire Attack Mode.

1. This should be accomplished with the first engine.
2. For fires on or above the 7th floor, elevators may be used if an elevator operator is available, a minimum of two companies should be transported a minimum of two floors below the reported fire floor.
3. The Company Officer is responsible to establish and announce “Fire Attack” stairwell.
4. When needed the Company Officer should assist the Back-up & Nozzle Firefighter carrying high-rise packs and tools to the floor below the fire floor.

B. The Engineer should grab the High-rise bag and Pack from the first arriving Engine.

1. The Engineer should proceed with the Engine Company to the standpipe outlet one floor below the fire floor.

C. The Back-up & Nozzle Firefighter should assist the Tailboard Firefighter or Company Officer carrying high-rise packs and tools to the floor below the fire floor.

1. Additional equipment (Tool Assignment for Engine Company Members) should include:
   a) High-rise Bag
   b) 4 Lengths of 2 ½” Hose in High-rise Bundle.
   c) Irons
   d) Keys

SECOND ARRIVING ENGINE ON FIRST-ALARM

I. Second arriving Engine on first-alarm

A. The Company Officer will assist the first arriving engine with Investigation/Fire Attack Mode.

1. For fires on or above the 7th floor, elevators may be used if an elevator operator is available, a minimum of two companies should be transported a minimum of two floors below the reported fire floor.

B. The Engineer shall establish the initial standpipe system and/or support a combination system with primary connections.

1. After securing a water supply, the Engineer should proceed to the standpipe and/or combination system connection, make the connections, and begin pumping operations.

C. The Back-up, Tailboard & Nozzle Firefighters shall assist the Engineer with the water supply and standpipe and/or combination system connections. Back-up & Nozzle Firefighter will then assist the Company Officer or Tailboard Firefighter with carrying high rise packs and tools to two floors below the fire floor.

1. Additional equipment (Tool Assignment for Engine Company Members) should include:

a) High-Rise Bag

b) 4 Lengths of 2 ½" Hose in High Rise Bundle.

c) 4 air bottles

d) Irons

NOTE: *ALL EQUIPMENT FROM THIS COMPANY SHOULD BE PLACED ON THE RESOURCE FLOOR*

- PRESSURE REDUCING DEVICES -

Pressure reducing devices prevent dangerously high discharge pressures from hose outlets. There are two major types of pressure reducing devices that can be installed on standpipe outlets:

Flow Restricting Devices
(Photo 6-12)

Flow restricting devices control the discharge pressure by restricting the flow to a reduced opening, which must be sized to a specific pressure and discharge rate. The most common type of flow restricting device is an orifice plate. Flow restricting devices do not reduce the static pressure (pressure with no water flowing), thereby allowing higher pressures at lower flow rates. Some jurisdictions require flow restricting devices to be adjustable or removable by the fire department.

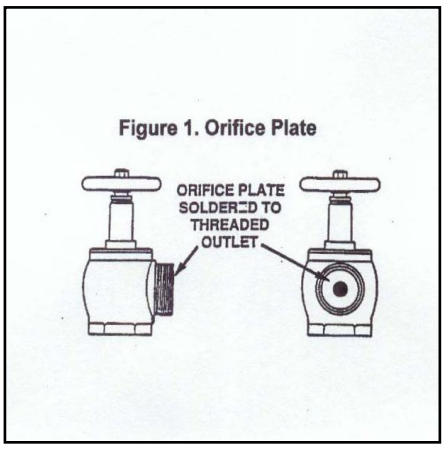


***Photo 6-12**: Flow Restricting Devices.*

Pressure Reducing Valves
(Photo 6-13)

Pressure reducing valves limit the pressure on the downstream side at all flow rates. The valve is set to deliver a specific pressure which will not be exceeded under any flow condition (I.e., static and flowing pressures will remain constant). A pressure reducing valve must be set for the specific pressure condition and is usually Not adjustable without special tools. These valves Are often installed on the connections between The standpipe risers and the automatic sprinklers on the individual floors of a high-rise building, in addition to hose outlets. The pressure and volume of water that are available at the standpipe inlet must be sufficient to supply hose lines that are expected to be connected to them and must not exceed a safe operating pressure. The required flow rate and the minimum & maximum pressure requirements are specified in NFPA 14.

***Photo 6-13**: A Pressure Reducing Valve.*

Adjustable PRV
(Photo 6-14)

Photo 6-14*: Adjustable Pressure Reducing Valve.*

Prior to 1993, the minimum pressure required by NFPA-14 for the primary riser was 65 psi at 500 GPM at the highest outlet in the system (see Table 1). This requirement anticipated that the fire department would utilize 2 ½" inch hoses with a 1 1/8" smooth bore tip, which requires only 50 psi nozzle pressure to operate (I.e., 65 psi minus 15 psi for FL / 100 feet of 2 1/2"). The maximum pressure allowable at an outlet was limited to 100 psi at the required flow rate, and the maximum static pressure at any outlet was limited to 175 psi. The same limitations applied to both 1 1/2 inch and 2 ½" inch outlets.

Note: *The 1 1/2-inch valves were limited to 100 psi residual pressure because these lines are usually considered occupant attack lines. Pressures exceeding 100 psi may overwhelm occupant users.*

The minimum and maximum pressure limitations were revised in 1993, after several reports of fires where crews had difficulty operating effective hose streams due to inadequate pressures (see table 2). A large number of fire department were found to be using 1 3/4" or 2" attack hose with combination fog nozzles, especially automatic nozzles, which require at least 100 psi at the nozzle to operate properly. As a result, in 1993 the pressure limit for all outlets greater than 1 1/2 inches was increased to 100 psi minimum flow pressure, and 175 psi maximum static pressure. The standard also specified that pressure reducing devices must be installed on 1 ½" inch outlets that would exceed 100 psi flow pressure at the required flow rate. Pressure reducing valves, which control water under flowing and static conditions, must be installed on all outlets that exceed 175 psi static pressure.

The higher pressures that are required today for 2 1/2 inch and larger outlets are intended to provide sufficient pressures for 2 1/2" hose lines to be operated in excess of one hundred feet, connected to outlets several floor below, and with nozzle pressures up to 100 psi. Nozzles that are designed to operate at lower pressures (50 psi) will be particularly useful when responding to buildings that have standpipe systems that were designed to meet pre-1993 standards.

Advantages and Problems of Pressure Reducing Valves

As stated previously, pressure reducing valves (PRV's) regulate both residual and static pressure. Prior to their development, the only type of pressure reducing device was the flow restricting devices which do not regulate static pressure In tall buildings, standpipe systems which utilize flow restricting devices were limited to approximately 20 stories per zone, to stay within the limit of 175 psi maximum static pressure. Each 20-story zone required its own fire pump(s) and fire department connection (FDC).

Today, standpipe zone heights are no longer restricted if PRV's are used. PRV's simplify the design and installation of sprinkler and standpipe systems by allowing their installation without a height limitation. The pressures may be very high in tall buildings (particularly at the lower-level floors), however, the pressure reducing valves should ensure that the static and residual pressures that are available at an outlet valve are within the required range for safe and effective hose stream operations. The rational for PRV's is the concern that firefighters would be exposed to dangerous operating pressures and forces if they connected hose lines to outlets near the base of the standpipe risers of substantial height, particularly those supplied by stationary fire pumps. For example, in a 275-foot-high building, a pressure of 234 psi is required at the base of the riser to overcome elevation and produce the minimum required outlet pressure of 100 psi at the riser's top outlet.

At this pressure, a standard 2 1/2" fire hose fitted with a 1 1/2" tip would produce a nozzle reaction force around 500 pounds. Some fire departments have encountered problems where the PRV's were not properly set for the required discharge pressure. In these cases, firefighters faced either inadequate or excessive hoseline pressures. The NFPA standard now requires a test/drain riser to be installed adjacent to the standpipe risers that are equipped with PRV's so that flow and discharge pressure can be set and checked during regular inspections.

- SUPPLYING STANDPIPE SYSTEMS

The first critical task facing the 2nd due Engine Companies arriving at a fire in a standpipe-equipped building is to establish a water supply by pumping into the FDC connections. 3” hose should be used to supply all standpipe systems. In the case of wet standpipes, fire department pumpers must augment the system to ensure flow needs are met at adequate pressures. In the case of dry standpipe systems, fire department pumpers provide the only water supply available for firefighting.

Master Stream Operations

7

Notes

-MASTER STREAM OPERATIONS-

The majority of structure fires that an Engine Company will encounter can easily be handled with the use of hand-lines. On some occasions there will be a fire that cannot be controlled by handlines and will require the engine company to deliver large quantities of water from a great distance. Master stream operations require a coordinated effort from the companies operating on scene, one of which is ensuring that all department members have been backed out of the building prior to flowing any master stream or elevated ladder pipe.

PHOTO 7-1: Heavy or advanced fire may require the use of master streams.

Master streams are deployed in situations, usually defensive, where the fire is beyond the ability to control with the use of hand lines or there is a need for fire streams in a location that is no longer safe for department members. By most definitions, any stream greater than 350 gpm and that requires mechanical assistance for handling is defined as a "master" stream. Also called 'large-caliber streams" or LCS, these long-reaching, high-volume streams may be portable (sometimes called "ground-based"), elevated (including ladder pipes and nozzles attached to elevating platforms), or mounted atop the engine apparatus itself.

SAFETY

Master stream devices present several safety considerations that members must address during these types of operations. First there is an increased likelihood that the higher flows will knock debris loose from the building causing it to fly through the air and strike people or apparatus. Second, when operating in the portable mode the master stream has a limited side to side range that it can operate in. Turning the nozzle too far left or right may cause the base to become unstable and tip over.

POSITIONING

When master streams are placed into service, it generally means that the interior offensive operations have been abandoned and a defensive posture is being employed. The master stream device must be properly positioned to provide an effective stream on a fire once the line is in operation, it must be shut down to be re- positioned. The safest exterior positions to operate a master stream are at the corners of the building. Setting up a master stream in front of the building, whether it is being operated from the top of the engine or from the ground, is a dangerous and ineffective tactic. Firefighters operating the stream are now in the collapse zone and may not have enough time to react to a sudden collapse of an exterior wall.

Should the need to operate a master stream from the front of a building, it should be set back far enough so that is will not be struck by any falling walls or debris. It is widely accepted figure in the fire service that the collapse zone should be one and one-half times the height of the tallest exterior wall. A store front that has a 20-foot wall should have a collapse safety zone of 30 feet to account for falling or bouncing debris, the further the better.

- DECK GUN -

One drawback with deck gun nozzles that sit as much as nine to 10 feet above the ground is a dramatic loss of effectiveness at low-angle operations. Taking into account the positioning limitations imposed by a narrow street combined with the excessive height of the deck gun above the ground, most of the water will be wasted as the stream hits the floor only 25 to 30 feet inside the structure. **(Photo 7-2)**

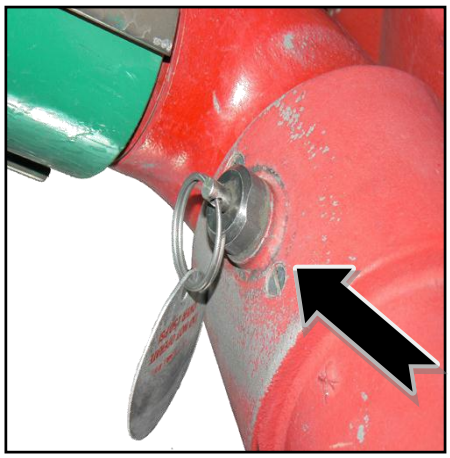


PHOTO 7-3: The Limiter Pin prevents the nozzle from being rotated too low.

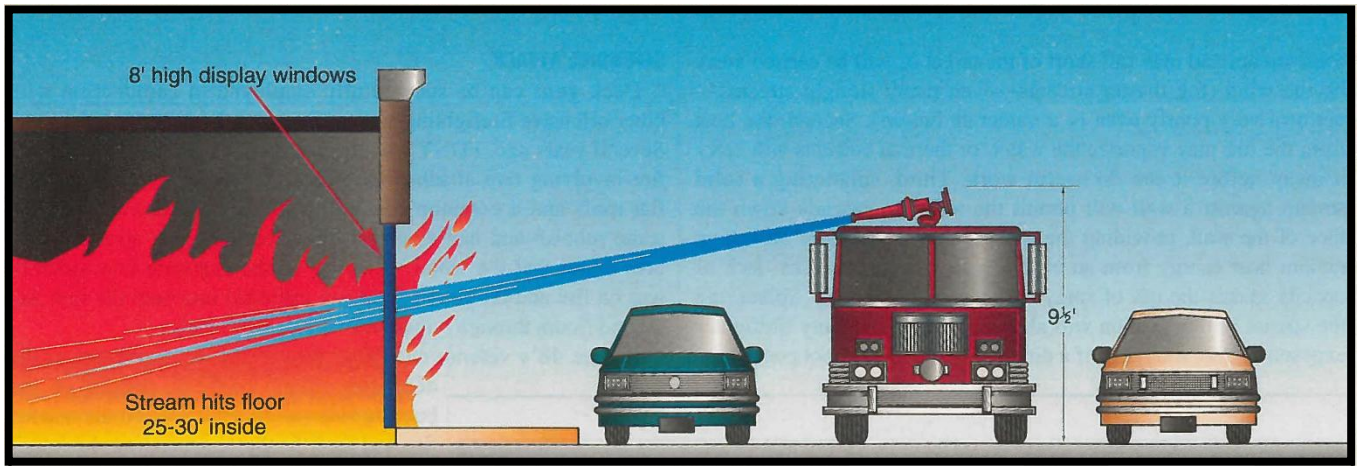


PHOTO 7-2: The Height of the apparatus mounted Deck Gun prevents its effectiveness in first floor fires.

The most effective operation in the use of the pre-connected deck gun is to direct a quick application of high-pressure water through the window to knock down the heavy fire while other member gets a handline into position by whatever means available. Faster fire control means increased life safety for civilians and firefighters. The stream angle at upper-floor operations reduces the chances of "pushing" the fire throughout the compartment and out into the hallway. Most of the water strikes the ceiling of the fire compartment and coarse droplets rain down on the burning contents. Employing a smaller tip than normally used with a deck gun and limiting the application of water further reduces the danger of forcing the fire from the compartment of origin. A 1½-inch tip is used to generate the high-velocity pressure necessary for reach and to conserve water**. (Photo 7-4)**

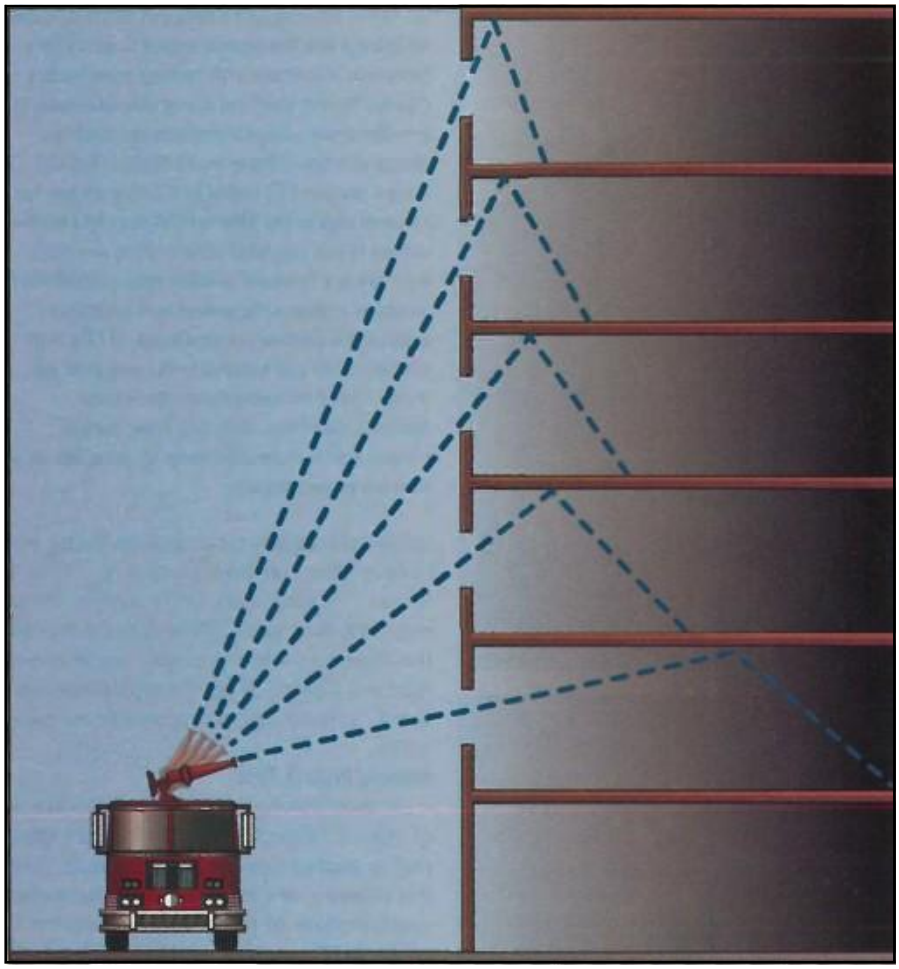


PHOTO 5-4: The penetration of deck gun streams decreases as the stream angles increase.

COMPONENTS

The two components that make up monitor are the nozzle and the base. The nozzle is typically a combination fog nozzle, or a stacked set of smooth bore tips varying in size and GPM delivery may be attached. The base is a portable stand used to attach the stinger for remote operations. The base has folding legs for stability and a single LDH inlet.

STINGER

(Photo 7-5)

The Stinger is a dual-purpose break-apart Monitor that can be used as a deck gun or portable monitor. The Stinger is mounted to a plumed outlet on the top of the engine with nozzle assembly attached. The fact that the Stinger is plumed allows it to be placed into operation rapidly without having to run a supply line to it. Based on the tip being used the Stinger can deliver up to 1,250 gallons per minute of water. A disadvantaged of using the Stinger in the deck-gun configuration is that it may require the engine apparatus to be parked in close proximity to ensure the proper reach, thus placing the engine in a potentially dangerous position.

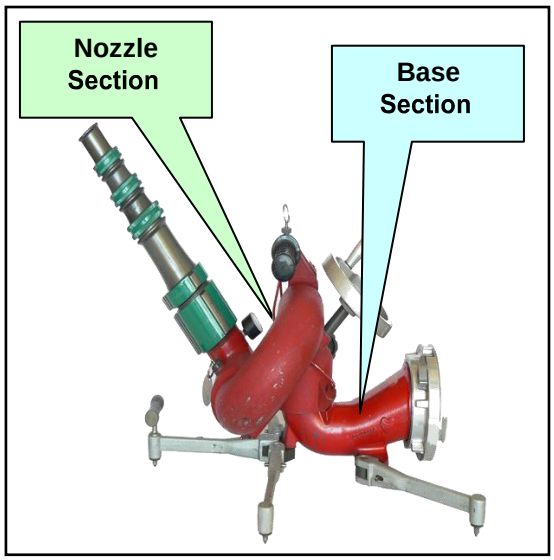


PHOTO 7-5: Stinger deck gun with stacked tips attached to portable base.

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NOZZLE ASSEMBLY

(Photo 7-6)

The nozzle assembly is the upper portion of the deck gun. Either a combination nozzle or stacked tip set can be attached to the nozzle assembly pipe. This assembly also includes a hand wheel for adjusting the angle of the tip and in-line pressure gauge. This assembly can be affixed to either the engine or to the portable base.

PHOTO 7-6: The nozzle assembly with stacked tip.

BASE

(Photo 7-7)

In the event that the stinger needs to be set up for a remote operation, the monitor can be removed and attached to a base. The base uses a 5” LDH inlet to supply the monitor The Base is a light weight portable stand used during a remote monitor operations. The base, normally stored in the rear compartment, can be remotely set up at any desired location and remove the dangers of the fire from the apparatus and any firefighters operating in the area. To use the base, simply set it up, remove the stinger from the engine and stretch the LDH supply line.

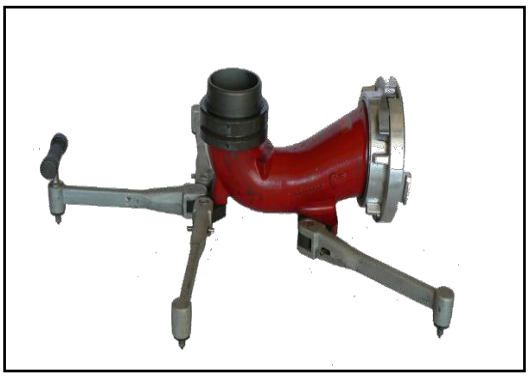


PHOTO 7-7: The portable base

-RAPID ATTACK MONITOR-

R.A.M
(Photo 7-8, 7-9)

R.A.M. is easily deployed and operated by a single firefighter. Its patent-pending hydraulic stability system harness's reaction force to stabilize the monitor. Four-fold-out forged aluminum legs with carbide-tipped ground spikes extend to the largest footprint in its class for exceptional stability. The rear ground spikes are angled to help the carbide tips grip the ground surface. The R.A.M. can be carried while attached to a charged line. Exclusive patent pending-design lowers friction loss and produces consistent stream quality in all ranges of motion. The R.A.M. can be stored pre-connected and features an ergonomic U-shaped valve handle. Attached safety strap includes storage pouch.

The Rapid Attack Monitor or R.A.M is a light weight, compact portable monitor that provides a rapid large water delivery capacity that is easily deployed by one firefighter. The R.A.M has a maximum delivery capability of 500 GPM at 75 pounds nozzle pressure. It can be supplied with either 2 ½" or 3" hoselines. Due to the design of the waterway the R.A.M has minimal appliance loss of 10 psi. Smooth bore 1 ½", 1 3/8", 1 ¼" or combination fog nozzles can be used to deliver fire streams.

PHOTO 7-8: R.A.M in operation

PHOTO 7-9: The Rapid Attack Monitor or R.A.M.

- OFFENSIVE APPLICATION -

Besides the defensive application for the R.A.M its use is well suited for interior offensive operations. This application provides the delivery of a large amount of water with long reach capabilities, allowing us to achieve knockdown in a large building or a long hallway. The R.A.M can easily be transitioned from an exterior fire attack to advancing inside the structure to accomplish an interior attack with minimal personnel. This advancement can be accomplished with a two-person attack team with one firefighter controlling the monitor by shutting it down fully or halfway to move it forward. The other firefighter can help move the hoseline supplying it. Once in position, the monitor can be fully opened again.

PHOTO 7-10: R.A.M in Transitional Operation

PHOTO 7-11: Advancing the R.A.M

PHOTO 7-12: Offensive Hallway Attack

Another advantage to the R.A.M is the ability to advance a smaller hoseline from it once the "bulk" of the fire has been extinguished. The R.A.M becomes similar to a extended lay from a 2 ½” shutoff. The advantage here is a large supply line already in place that can easily supply a 2 ½” or 1 ¾” of handline with lower gpms. A good application for this feature is with garden apartments, Strip Malls, warehouses and other occupancies with long setbacks.

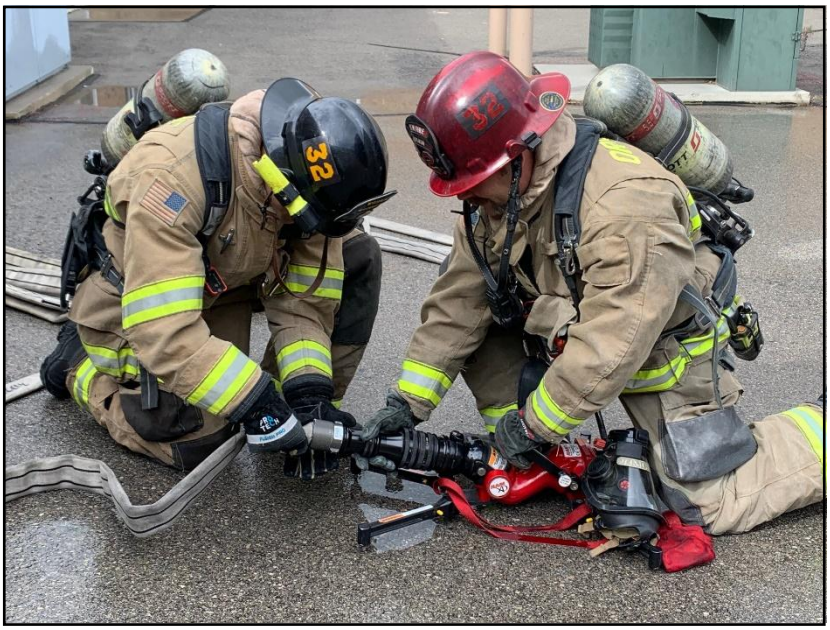


PHOTO 7-13: Extending the R.A.M

Wildland Operations

8

Notes

- WILDLAND OPERATIONS -

Wildland or grass fire operations can present many challenges to the first arriving companies, and their initial actions will play a major role in the outcome of the fire. There are many factors affecting the fire behavior and spread of wildland fires, main factors being: fuel types, topography and the weather. Unlike fighting fires in a structure where the fire is contained in a “box”, fighting fire in the wildland environment can be challenging due to the fact that many of the tactics applied to structure firefighting do not apply in the wildland scenario.

The majority of wildland fires that the Draper Fire Department responds to are usually grass fires in open fields or lots, and can be easily extinguished with mobile attack or hose lays. While commonly, these fires are quite elementary, there should be no complacency with Wildland. There are many areas within the Draper Fire Department jurisdiction that are complex and require a lot of resources to control and extinguish. Some of these areas have limited access and will necessitate tactics such as mobile attack, progressive/extended hose lays, and possibly even aircraft, and/or firing operations. In addition to our own response jurisdiction, the Draper Fire Department provides mutual aid to neighboring agencies with a vast and complex Wildland Urban Interface (WUI).

There are five major common denominators of fire behavior on fatal and near-fatal fires. Such fires often occur:

1. On relatively small fires or deceptively quiet areas of large fires.
2. In relatively light fuels, such as grass, herbs, and light brush.
3. When there is an unexpected shift in wind direction or wind speed.
4. When fire responds to topographic conditions and runs uphill.
5. Critical burn period between 1400 and 1700

The wildfires that Draper Fire Department respond to typically hit most, if not all of these five factors. Most wildfires we go on again, are very simple, but when they do go past what our normal response is, we quickly are into a specialty area. This is why it is imperative that we are prepared for these low frequency, high risk incidents when they occur.

This chapter is intended to serve as a general guideline for the DCFD during “on duty operations”. It includes tools, scenarios, and tactics that are most likely to be encountered and is not meant to be an all-inclusive guide. This does not include guidelines for “team deployment” scenarios. If clarification or further information is desired, please see a member of the Wildland Team.

- WILDLAND APPARATUS -

The Draper Fire Department deploys two different types of Wildland/Brush rigs (engines), as defined by ***FIRESCOPE***; Type VI and Type IV **(Photo 8-1)**. Currently there are two Type-VI Engines (Brush 32/E-632 & Brush 34/E-643). Typically, we use the call designation of "Brush" when on 800 mHz communication and E- 63_ when talking with Northern Utah. Additionally, there is one Type-III Brush rig (324). There is a significant difference between these two types of brush rigs, including: water tank size, vehicle handling, crew seating, and operational applicability. However, they're both able to pump and roll using an auxiliary or "pony" pump. An in-service check should be performed at the beginning of each set during "Wildland season". Detailed checks should be performed by Wildland team members monthly.

PHOTO 8-1: Wildland Engines

Equipment Features

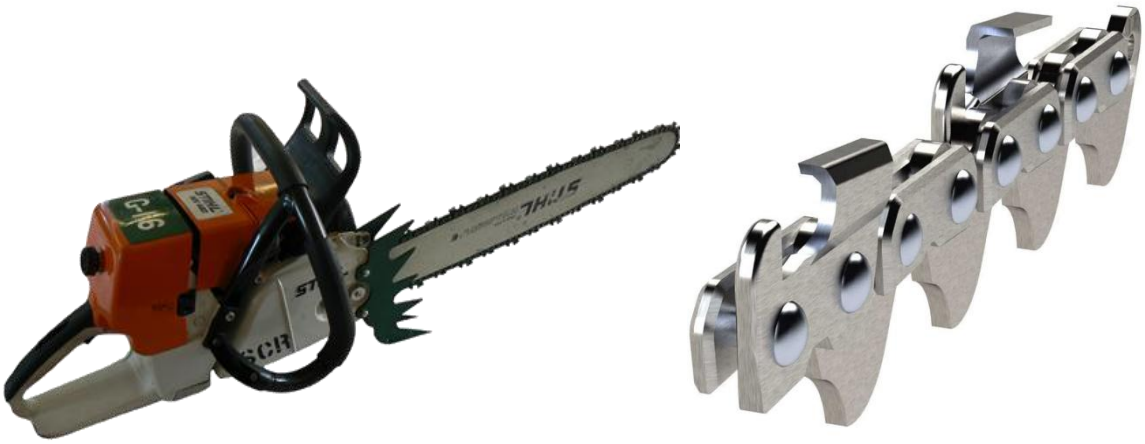
CAPABILITIES	E433	E632/E634
Pump Capacity (GPM)	150	150
Water Tank (Gals)	900	400
Foam	none	Class A/none
Crew Seating	3	4/3
Reel Line	1 @ 200'	2 @100'

- WILDLAND EQUIPMENT -

Scraping tools

Tools utilized in removing fuel from the ground to assist in wildland fire suppression. Only to be utilized as cutting tools when appropriate. If it doesn't cut the material after a couple of blows, sharpen the tool or get a pulaski.

Wildland Chainsaw



Stihl 461 chainsaw that is configured specifically for Wildland Fire operations. Differences include, but are not limited to: dogs attached at base of the bar and wood chain. Saws are utilized in fire line construction for shrubbing, falling trees, and bucking fallen trees. **Only to be utilized on fires by S-212 trained personnel.**

Chaps

REQUIRED personal protective equipment anytime a wildland chainsaw is in operation, whether for training or for fire suppression. Also required for those in close proximity.

Dolmar

Fuel can that is utilized for chainsaw operations. Carries on the larger portion 2 cycle, 50:1 mixed fuel. Always ensure there is mixed fuel in the container prior to adding to equipment. Smaller portion of the can carries bar oil.

Bendix King/VHF portable radio

Radios that are switched to in extended attack operations to communicate with wildland specific resources. Utilize team members for regular training on operation.

Firing devices

In wildland fire, the tactic of “fighting fire with fire” is used at times. The tactics are only to be used at the Draper Fire Department when resources are directly supervised by a single resource boss or greater.

Hose packs

Every Engine in the DCFD should have (2) hose packs. One for 1.5” hose bundles with equipment, and one with 1” hose with equipment. The 1.5” hose pack should have three sections of hose tied in a “gasner” style, secured with paracord. Each section of hose should have an inline tee pre-attached to it. Loose accessories in the bag should include a 1.5” barrel nozzle, a 1.5” to 1” adapter, and a hose clamp. The 1” hose pack should have three sections of hose, each with a pre-attached barrel nozzle. Loose equipment should include only a nozzle. Utilize the hose roller at Station 32 or the 2x4 board to assist in rolling up the hose after use. If not properly repacked, deployment for the next firefighter can be significantly hampered.

Hose clamp

Utilized for progressive hose lays. Be sure to not pinch the hose when applying to avoid popping sections. Z fold the hose prior to the clamp and leave water flowing to ease application. DO NOT clamp booster reels or any hose greater than 1.5” in diameter.

Bladder bag

5-gallon bag to be assembled and used on small remote fires to avoid having to put hose on the ground for an extended lay.

Hose Roller/Hose board

Roller housed at St 2, to be utilized to easily re-roll hose for the progressive bags. Much easier to get the hoses reloaded with this, than with the board that is on each brush rig.

- WILDLAND FIRE SUPPRESSION -

A wildland fire by itself can quickly become a complex incident. Adding structures to the equation can create further complications. The suppression of grass or vegetation fires can pose many problems for crews, including access problems, rate of spread, and endangerment of adjacent structures. Oftentimes these fires require additional companies to suppress because of the geographical area in which they encompass.

One of the first tactical requirements that needs to be identified is the direction of travel of the head of the fire and if this fire is endangering any structures. Should this be the case, the first arriving company must aggressively attack and suppress these fires.

Size up of wildland fires should begin at the start of each shift. What is the weather like? How long has it been since we last had rain? What is the experience of the crew in wildland fire? Then once the page is received for the fire: Is this in a “hazard area”? How close are structures? What is the wind doing? Etc.

The three things that most affect wildland fire behavior is: wind, fuel, and topography. They each can greatly impact how quickly we see fire growth as well as how quickly we need to be prepared to request additional resources.

Upon arrival to a wildland fire, our size-up is continual and should never stop. Situational awareness is imperative in all aspects of firefighting, but particularly in the wildland arena. If we don’t have a grasp on enough information as to what is occurring, we need to be cautious as to how we engage.

PHOTO 8-2: Type 1 Engine on Structure Protection

Relay the following information to dispatch upon first visual contact:

Descriptive Location or Legal	
Incident Name	
Size (in acres)	
Spread Potential	Low Moderate High
Values Threatened	None Structures Others Life
Additional Resources	

Once on scene the initial arriving unit needs to complete a formal size up on the radio for additional incoming units. The image above is from the field Incident Organizer provided by Northern Utah Interagency Fire Center (NUIFC). It is a good industry standard to guide your radio size up on a wildland fire.

Additional information that may be pertinent to relay over the radio for additional resources could include the following:

- Best access to the fire
- Tactic being employed (rolling attack, progressive hose lay, etc.)
- Where an anchor is being established
- Location of division breaks if being utilized
- Water supply location(s)
- Whether next arriving units need to respond to a different address to begin suppression efforts at multiple locations simultaneously

For the purposes of describing a wildland fire in terms of its needs, complexity and the amount of time to control it, wildland fires can be divided into three categories:

Initial Attack

An Initial Attack Fire is one in which the fire is generally contained by the first dispatched attack units (1st alarm) without a significant augmentation of reinforcements within about two hours or less, after first attack action.

Extended Attack

(Photos 8-3,8-4)

An Extended Attack fire (multi-Alarm) is one in which the first dispatched attack units must be substantially augmented by additional ground or possibly air units to contain the fire and may take several hours to completely extinguish and control.

PHOTOS 8-3, 8-4: Dry Canyon Fire 2019

Major Fire

(Photo 8-5)

Often referred to as campaign fires, these fires are large and complex in nature and may take days or weeks to control and will utilize extensive units from multiple jurisdictions and agencies to extinguish.

PHOTO 8-5: Range Fire 2020

- WILDLAND FIRE RESPONSE-

- **Brush fire in a residential area** - Full station response for the district it is in. Backed by the closest Brush unit.
- **Brush fire in a Hazard area** – Full station response for the district it is in Code 3. Other Brush units Code 3. All others Code 1 until units on scene advise of severity.
- **Multiple calls for brush fire in Hazard area** – All DCFD units Code 3.

MA personnel bring Brush Trucks and Engine/Truck personnel bring the Engine/Truck. If the MA is out on a call, split the crew to get both resources there. The MA personnel will be there soon and we will need the resources brought from both apparatuses. Once on scene, Captain's discretion as to who is on which apparatus to best suit needs with consideration for qualifications/training.

Brush Fire Second Alarm

- Utah County Fire Department. Request available 1J Fire units from Central Dispatch
- Utah County Fire Warden. Request through Central for 3A304 (385)-290-0670
- Pleasant Grove FD -Request an Engine and a Brush. No ambulance. BC at their discretion
- Provo FD - Request an Engine and a Brush. No ambulance. BC at their discretion.
- DCFD Single Resource Boss/trainee to run Wildland Branch - BC to maintain IC and Single Resource Boss to run Wildland Branch to assist in Span of Control and utilizing specialized training we have within the department. Also freeing up BC for Unified Command coordinating. Should operate similarly to RO or HazMat Branch Director on a SRT incident. IC would run any medical or structure fire that may occur within the incident.
- Everbridge page to Wildland Team - Off duty wildland team members will respond from home and get their team gear and come to help staff the hill. Also, to be utilized for extended attack mutual aid fires, so they can relieve duty crews to return to the city.

***If the fire is not going to be quickly caught by DCFD resources, strike the second alarm with Vecc Dispatch and contact NUIFC 801-495-7600. They have automated responses they can get initiated so we get ahead of the game rather than be behind. (Aviation, USFS, BLM, hand crews, etc.) Relay to NUIFC: location of the fire, Incident name, approximate size, spread potential, and values threatened (none, structure, others, life). Once a Support Officer and/or Branch Director arrives, initiate a full Field Fire Report for NUIFC.

Benchmarks in the Wildland arena are again different from those that we are accustomed to with structure fires. Some benchmarks to be used include:

Confined

Fire personnel have the fire confined to a determined area that has a high likelihood of stopping the fire, but it may still increase in size before set containment.

Contained

The fire has “line” all the way around the perimeter. Whether that be wet line, cold black, saw line, scratch line, roads, etc.

Controlled

There’s no way that this fire is going to increase in size/acreage but there may be some interior burning and/or smoke.

Out

The entirety of the fire area is completely void of any heat or smoke. Able to be occupied by civilians without any public safety presence and no need for any follow up to check up on the fire.

- ATTACK METHODS -

In all wildland fires, crews must establish an anchor point prior to beginning their attack. There are two primary methods of attack used on wildland fires:

1. Direct attack

When fire attack is practical to do directly engaging the fire itself. This is achieved by either cooling the fuels with water application, removing fuel from the fire by constructing fire line, or utilizing hand tools to smother the fire.

Direct Attack tactics that may be used include, but are not limited to:

- Rapid water application utilizing preconnected hoselines (booster reel, bumper lines, crosslays)
- Progressive hose lays
- Rolling/mobile attack
- Constructing handline with tools
- Fast, large volume water with the deck gun
- Aviation water/retardant drops

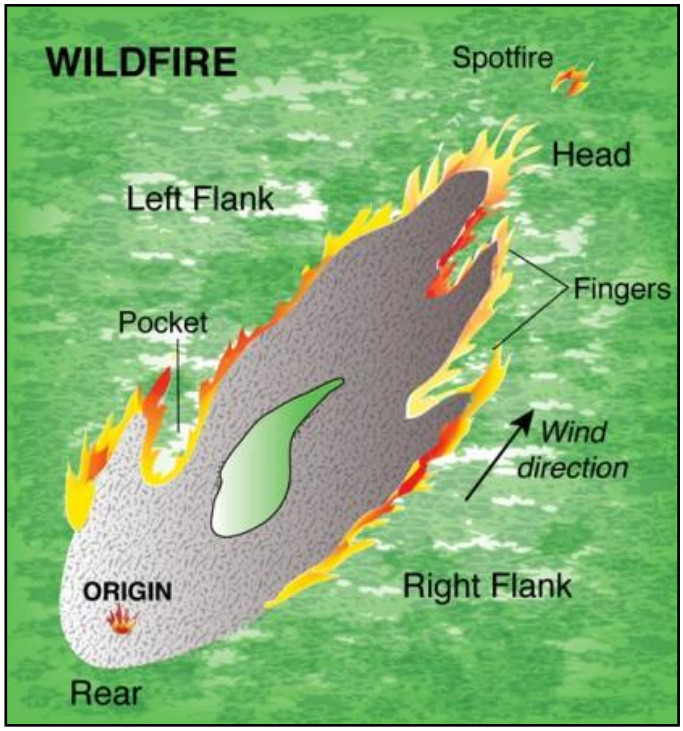


PHOTO 8-6: Wildfire Terminology

Three methods of employing direct attack involve Pincer, Tandem, and Envelopment (hotspotting). To choose between these three methods, one must quickly determine best actions based on multiple variables, some including: wildfire anatomy, knowing the area being affected by the wildfire, access points, number of and ability of resources, as well as fuel, wind, and topography.

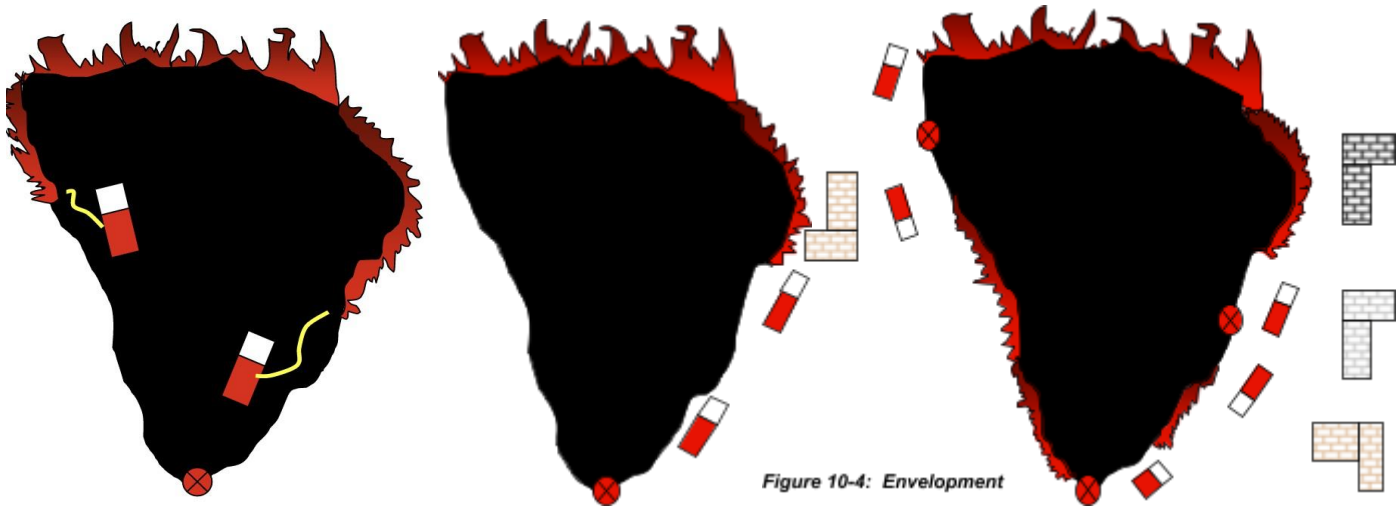


Figure 10-4: Envelopment

PINCER TANDEM ENVELOPMENT

2. Indirect attack

When control lines are built or utilized to then backfire off of, or to wait for the fire's progress and then hold the line. Typically not a tactic utilized within Draper fire jurisdictions. **Backfiring should only be done under the direct supervision of a Qualified Single Resource Boss or higher and IC must be notified of the plan prior to execution.** (Photo 8-7)

PHOTO 8-7: Backfiring Operation

- STRUCTURE PROTECTION -

Structure protection, while a common assignment for us on fires, can be a very dynamic assignment. Strategies and tactics can vary widely depending on location, resources, and fire behavior. The following are to be utilized as general guidelines and not an end all be all. There are many resources available to gain further knowledge and understanding on the subject. **(Photo 8-8)**

PHOTO 8-8: Type 1 Engine on Structure Protection

Tactical Actions

- CHECK AND GO -

  A rapid evaluation to check for occupants requiring removal or rescue. Used when fire spread, intensity, lack of time or inadequate defensible space prohibit firefighting resources from safely taking action to protect the home when the fire front arrives. Evaluate the structure for follow up action when additional resources become available, the fire front passes or fire behavior intensity is reduced

- PREP AND GO -
  Implies that some preparation of the structure may be safely completed prior to resources leaving the area: A tactic used when a Safety Zone and TRA are not present and/or when fire spread and intensity are too dangerous to stay in the area when the fire front arrives, but there is adequate time to prepare a structure for defense ahead of the fire front. Again, re-evaluate/re-engage once fire behavior allows.
- PREP AND DEFEND -
  Used when a Safety Zone and TRA are present and adequate time exists to safely prepare a structure for defense prior to the arrival of the fire front. An ideal multiple resource tactic especially in common neighborhoods where efforts may be coordinated over a wide area. A tactic used when it is possible for fire resources to stay when the fire front arrives. Fire behavior MUST be such that it is safe for firefighters to remain and engage the fire
- TACTICAL PATROL -
  A tactic where the key element is mobility and continuous monitoring of an assigned area. The goal is to patrol areas downwind of potential ember showers This tactic should be used to extinguish hot spots or secondary structure ignitions, and address safety issues such as power lines, weakened trees, and other hazards.
- ANCHOR AND HOLD:
  This tactic utilizes control lines and large water streams from fixed water supplies in an attempt to stop fire spread. The goal is to extinguish structure fires, protect exposures, and reduce ember production. Fixed engines should be spotted in safe areas where they can safely withstand any fire situation.

General guidelines

- Always position apparatus for quick egress
- Maintain a minimum of 100 gallons of water in your tank for personal protection
- Pre-establish trigger points for when to leave
- Remove flammable materials from the surrounding area when time permits. (Live fuels, wood piles, patio furniture, BBQs, etc.)
- Utilize homeowner garden hoses when applicable. (fire extinguishment, pretreating structure/fuels, tank refill)
- When utilizing a fire hydrant, consider the need for mobility of units (2.5” intake rather than 5”)
- Do not change assignment and engage in interior structural firefighting unless the IC has been notified prior.
- Keep fire out of heavier fuels (suppress in lighter fuels)
- Close windows and doors, including garage, leaving doors unlocked
- Consider applying foam to the structure (roof and siding) and/or fuels

-SAFETY-

Lookouts

Standard Firefighting Order #5 states: Post lookouts when there is possible danger. Obviously there is danger present whenever we are involved in a wildland fire response. Many of our fires are small and extinguished without any formal LCES being established. It is at the discretion of the IC when to formally designate a lookout for the incident. When choosing an individual as a lookout, things to consider: wildland fire experience, solid knowledge of fire behavior and the ability to recognize and monitor other environmental hazards, knowledge of crew locations and trigger points, good communicator, knowledge of weather patterns and signs of incoming weather changes, and ability to advise all crews of fire behavior changes (BK and 800mHz radio competency). Be sure to choose a good vantage point, preferably with a good overview of the entire area where firefighters are located, including escape routes and safety zones.

Communication

Communication problems are a common factor in both wildland and structure mishaps. Ensuring that everyone knows what is going on, is always important, but especially in the dynamic wildland fire environment. Always ensure that there is communication with supervisors and adjoining resources, to include federal and county resources on extended incidents. Take the time to maintain familiarity with BK radios and their basic operations.

Escape Routes

Access routes to get to predesignated safety zones. These can be trails, roads, fire lines, or a combination. Distance of the escape route to the safety zone should be determined based on anticipated fire behavior and should be continually reassessed.

Safety Zone

A preplanned area of sufficient size and suitable location that is expected to protect fire personnel from known hazards without using fire shelters.

Temporary Refuge Area (TRA)

An identified area where firefighters can immediately take refuge for temporary shelter and short-term relief in the event that emergency egress to an established Safety Zone is compromised. Examples: lee side of structure, inside of structure, large lawn or parking area, cab of apparatus

Firefighter and public safety is the first priority in every fire management activity. Using the Standard Firefighting Orders, firefighters are guided to make a fire behavior prediction that considers the fire potential at the time of contact with the structure. If at any time risk to firefighters is determined to be too great, an alternative action should be selected

It is important to remember that fire conditions can change very quickly, so constant observation and reassessment is necessary; the tactic selected may need to change. Tactical maneuver or agility is essential to ensure firefighter safety since legitimate Safety Zones should always be identified in the WUI environment in conjunction with a viable escape route; however, they may not always be immediately available. Often a Temporary Refuge Area (TRA) is more accessible in the WUI environment. A TRA will provide temporary shelter and short-term relief from approaching fire without the use of a fire shelter.

Personal Protective Equipment

Wildland Personal Protective Equipment

Required PPE for all responding personnel on brush fires:

1. Department issued brush jacket or wildland shirt (nomex)
2. Nomex pants (duty pants or department issued brush pants)
3. Department issued/approved leather boots
4. Department issued/approved helmet
5. Eye protection
6. Leather gloves
7. Wildland fire shelter if available (optional within 200’ of apparatus)*

*When operating past preconnects of the apparatus a fire shelter must be worn unless unavailable. (All Engines, Ladders, and Brush Trucks have 2 shelters on board).

ME MAN IN THE ARENA

It i not th cr1hc who count. · Not t,e man
"ho poi11ts out ho\ the strong ma11
tutnble , or where the doer of deed
could have done them better.. The credit
belqri s to the man , ·ho i actuaUy in the

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hile daring greatly, so that his plaice shall
n v:er b ,vith tho ooldand timid oul
who neither know victory nor defeat..

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