Fire Hose, Nozzles, And Appliances

Verdugo Fire Academy Class XI

First Day

- March 1, 2008
- Morning

Part I. Introduction

- 20 mins.

Fire Hydraulics

- Deals with the study of water at rest and in motion, as related to fire suppression.
- Deals with properties of energy, pressure, and water flow.

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Flow

- • Volume of water that is being moved
- • Measured in gallons per minute (gpm)

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Pressure

- Amount of energy in a body or stream of water.
- Measured in pounds per square inch (psi).
- Required to push water through a hose or to a higher elevation level.
- Pumps usually provide the pressure.

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Friction Loss

- Loss of pressure as water moves through a pipe or hose
- Loss represents the energy required to push the water.
  - Greater the flow rate in same size hose, the greater the friction loss
  - Smaller hose with same flow, greater friction loss
- All else equal, loss proportional to distance

Elevation Pressure

- Elevation affects water pressure.
- Elevated water tanks supply pressure to pipes due to elevation.
- Difference between nozzle elevation and engine elevation affects pressure.
  - Hoses laid downhill have greater pressure.
  - Hoses laid up stairs will have less pressure.

Water Hammer

- Surge in pressure caused by sudden stop in the flow of water.
- Shock wave is transmitted back through the hose.
- Can damage hose, couplings, and plumbing.
- To prevent, open and close Valves/Nozzles slowly.

Part II. Hose

- 30 mins.

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Functions of Fire Hoses

- Attack hose
  - Carries water from engine to the nozzle onto a fire
  - Carries water from engine to master streams
  - Carries water to standpipe and sprinkler systems
- Supply hose
  - Carries water to the engine
  - May come from a hydrant, another engine or a Static source (thru a Hard Suction)
  - Carries large quantities at lower pressures

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Sizes of Hose (1 of 3)

- Small Diameter Hose
  - 1 to 2 inches in diameter
  - Used as attack lines small outdoors fires
- Each section is usually 50’ long

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Sizes of Hose (2 of 3)

- Medium Diameter Hose
  - 2 1⁄2" or 3" in diameter
  - Used as attack line or supply line
- Large hand lines usually use 2 1⁄2 inch.
  - Master stream and fire department connections (FDC) often use 3 hose.
- Each section is usually 50 long.

Sizes of Hose (3 of 3)

- Large Diameter Hose
  - 3 1⁄2 to 6 in diameter
  - Standard diameter is 4 or 5.
- Standard length is 50 or 100 long.
- Used as Supply lines only

Pressure Testing

- Attack hose
  - Tested annually
  - Tested to 300 psi.
  - Designed for use up to 275 psi
- Supply hose
  - Tested annually
  - Tested to 200 psi
  - Designed for use up to 185 psi

Hose Construction (1 of 2)

- Fire hose constructed of inner water-proof liner and one or two outer layers
- Outer layers
  - Provide strength for high pressures
  - Made from synthetic fibers
  - Provide some abrasion protection
  - Can be single or double jacket hose
  - Can be rubber-jacket hose

Hose Construction (2 of 2)

- Inner waterproof liner
  - Prevents water leakage
  - Provides smooth surface to reduce friction
- Usually made of synthetic rubber compound thin flexible membrane
- Attached to outer covering

Hose Couplings

- Used to connect individual lengths of hose
- Used to connect hose to hydrants, valves, nozzles, and fittings
- Two types
  - Threaded
  - Non-threaded (Storz-type)

Threaded Couplings (1 of 2)

- Used on most hose up to 3 or 4 inch.
- A set consists of male and female couplings.
  - Male threads are on the outside.
    - Larger lugs on male!
  - Female threads are on the inside.
  - Female couplings swivel. Lugs on the swivel!
- Fire hose has a male on one end and a female on the other.

Threaded Couplings (2 of 2)

- Higbee indicators indicate proper thread alignment, (for Higbee Cut on the threads).
- Female couplings have a gasket to prevent leaks and require periodic replacement.
- Standardized threads. National Standard

Installing the swivel gasket

Step 1: Fold the new gasket, bringing the thumb and forefinger together, creating two loops.

Step 2: Place either of the two loops into the coupling and against the gasket seat.

Installing the Swivel Gasket

- Step 3: Using the thumb, push the remaining unseated portions into the coupling until the entire gasket is properly positioned against the coupling seat.

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Storz-type Couplings

- Has neither male nor female ends
- Most often used in large diameter hose
- Couplings are mated face-to-face and turned clockwise one third turn.
- Adapters are used to connect to threaded couplings.

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Skill Drill 16-2

Performing the One-Fire Fighter Foot-Tilt Method of Coupling a Fire Hose

Step 1: Place one foot on the hose behind the male coupling. Push down with your foot to tilt the male coupling upward.

Step 2: Place one hand behind the female coupling and grasp the hose.

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Skill Drill 16-2

Performing the One-Fire Fighter Foot-Tilt Method of Coupling a Fire Hose

- Step 3: Place the other hand on the coupling swivel. Bring the two couplings together and align the Higbee indicators. Rotate the swivel in a clockwise direction to connect the hoses.

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Skill Drill 16-3

Performing the Two-Fire Fighter Method for Coupling a Fire Hose

Step 1: Pick up the male end of the coupling. Grasp it directly behind the coupling and hold it tightly against the body.

Step 2 The second fire fighter holds the female coupling firmly with both hands.

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Skill Drill 16-3

Performing the Two-Fire Fighter Method for Coupling a Fire Hose

Step 3: The second fire fighter brings the female coupling to the male coupling.

Step 4: The second fire fighter aligns the female coupling with the male coupling. Use the Higbee indicator for easy alignment.

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Skill Drill 16-3

Performing the Two-Fire Fighter Method for Coupling a Fire Hose

- Step 5: The second fire fighter turns the female coupling counter clockwise until it clicks. This indicates the threads are aligned.

- Step 6: Turn the female coupling clockwise to couple the hoses

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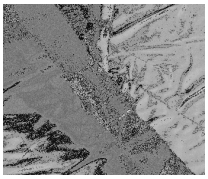
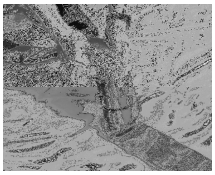
Skill Drill 16-4

Performing the One-Fire Fighter Knee-Press Method of Uncoupling a Fire Hose



- Step 1: Pick up the connection by the female coupling end



- Step 2: Turn the connection upright, resting the male coupling on a firm surface.

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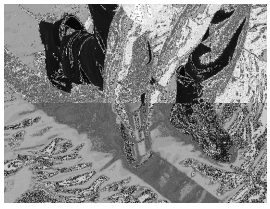
Skill Drill 16-4

Performing the One-Fire Fighter Knee-Press Method of Uncoupling a Fire Hose



Step 3: Place a knee on the female coupling and with body weight press down. Turn the female swivel counterclockwise and loosen the coupling.

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Skill Drill 16-5

Performing the Two-Fire Fighter Stiff-Arm Method

- Step 1: Two fire fighters face each other and firmly grasp their respective coupling.

- Step 2: With elbows locked straight, the fire fighters push towards each other.

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Skill Drill 16-5

Performing the Two-Fire Fighter Stiff-Arm Method

Step 3: While pushing towards each other, the fire fighters turn the coupling counterclockwise, loosening the coupling.

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Skill Drill 16-6

Uncoupling Hose with Spanners

Step 1: With the connection on the ground, straddle connection above the female coupling.

Step 2: Place one spanner wrench on the female coupling with handle to the left.

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Skill Drill 16-6

Uncoupling Hose with Spanners

Step 3: Place the second spanner wrench on the male coupling with the handle to the right.

- Step 4: Push both spanner handles down toward the ground, loosening the connection.

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Attack Hose (1 of 4)

- 1 ½ and 1 ¾ inch
  - Most common attack line
  - Both use 1 ½" couplings
- Can be operated by one fire fighter
- Most common preconnect lengths of 150 to 350
- 1 ½" generally flows 60-125 gpm
- 1 ¾" generally flows 120-180 gpm

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Attack Hose (2 of 4)

- 2 ½ hose
- Used to attack larger fires
  - Generally flows about 250 gpm
  - Takes at least two fire fighters inside a building
  - Weight per 50' section
  - Without water, weighs 30 pounds
  - With water, weighs about 200 pounds
  - Can flow up to 350 gpm

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Attack Hose (3 of 4)

- Booster hose
  - Usually carried on a hose reel with 150' to 200'
  - Made of rubber with steel wire to keep shape
  - Can be advanced by one fire fighter
  - 1 line flows 40-50 gpm
  - Used for small outdoor fires and trash dumpsters

1" Attack Hose (4 of 4)

- Forestry hose
  - Typically 1 or 1 ½ inch
  - Used for grass, brush, or forestry fires
  - Extremely maneuverable

Supply Hose

- Used to supply attack engine
- Ranges from 2 ½ to 6 inch, 50 to 100 in length. 4 to 5 inch most common.
- Large diameter is more efficient than 2 ½ inch
- Two additional types
  - Soft suction 12 to 25 in length
  - Hard suction 10 to 20 in length

Break

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III. Hose Care,Maintenance,and Inspection

- 15 mins.

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Types of Damage to Hose (1 of 4)

- Mechanical
  - Abrasion from road surfaces
  - Broken glass and sharp objects
  - Abrasion from hose reloaded dirty
  - Vehicles running over it
  - Couplings being damaged
  - Couplings being dragged

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Types of Damage to Hose (2 of 4)

- Heat and cold
  - Direct contact from fire
  - Burning coals and embers
  - Hot surfaces such as heating units and exhaust pipes
  - Freezing can rupture inner liner and break outer liner fibers.
  - Lines may be frozen or encased in ice.

Types of Damage to Hose (3 of 4)

- Chemicals
  - Encountered at many incidents, including vehicle fires and accidents
  - Wash hose as soon as possible with approved detergent.

Types of Damage to Hose (4 of 4)

- Mildew
  - Grows on fabrics in warm, moist conditions
  - Feeds on natural fibers and causes the hose to rot
  - Modern hose has synthetic fibers and resists mildew.
  - Rubber-covered hose fibers are protected from mildew.

Clean contaminated hose

- Lay hose out straight & flat.
- Rinse hose with water.
- Gently scrub hose, paying attention to soiled areas.
- Turn hose over. Repeat steps two and three.
- Rinse hose.
- Hang hose to dry before storing.

Maintaining, and Inspecting Hose

- Hose inspections
  - Perform quarterly and after each use
- Hose records
  - Written history of each length of hose

IV. Hose Appliances

- 30 mins.

Hose Appliances

- A hose appliance is any device used in conjunction with a fire hose for the purpose of delivering water.

Hose Appliances (1 of 10)

- Wyes
  - Split the stream into two hose streams
  - Commonly split a 2 ½ hose into two 1 ½
  - Gated wyes have two quarter turn valves.

Hose Appliances (2 of 10)

- Water thief
  - Gives the ability to tap into a 2 1/2" hose line with an 1 1/2"
  - Has a 2 ½ inlet, a 2 ½ outlet, and two 1 ½ outlets

Hose Appliances (3 of 10)

- Siamese
  - Combines two hose lines into one
  - Has two female inlets and one male outlet
  - Often used on engine outlets, master streams, and fire department connections (FDCs)

Hose Appliances (4 of 10)

- Adaptors
  - Used to connect same size hoses but with dissimilar threads
  - Are double-female or double-male

Hose Appliances (5 of 10)

- Reducers
  - Used to attach smaller hoses to larger hoses
  - Commonly used to reduce a 2 1⁄2 hose to a 1 1⁄2 hose

Hose Appliances (6 of 10)

- Hose jacket
  - Used to stop a leaking section of hose
  - Consists of a split metal cylinder that fits tightly over the hose

Hose Appliances (7 of 10)

- Hose roller
  - Used to protect a line being hoisted over an edge
  - Prevents chafing and kinking

Hose Appliances (8 of 10)

- Hose clamp
  - Used to temporarily stop the flow of water in a hose:
  - so the hydrant can be opened
  - Hose that has burst

Hose Appliances (9 of 10)

- Master stream devices
  - Large capacity nozzles supplied by two or more lines
  - Include deck guns and portable nozzles

Hose Appliances (10 of 10)

- Valves
  - Control the flow of water through hose or pipe
  - Must be opened and closed slowly

Types of Valves (1 of 2)

- Ball valves
  - Used on nozzles, gated wyes, and engine discharges gates
  - Consist of a ball with a hole in it
  - When hole is in-line with inlet and outlet, water flows.
  - When ball is rotated, flow shuts off.

Types of Valves (2 of 2)

- Gate valves
  - Used on hydrants and sprinklers
  - Rotating spindle causes gate to move across opening
- Butterfly valves
  - Used on large pump intake
  - Opened by rotating handle one quarter turn

V. Hose Rolls

- 25 mins.

Hose Rolls

- Rolled hose is an efficient way to transport a single section of fire hose.
- Hose can be rolled in many different ways, depending on how it will be use

Types of hose rolls

- The straight hose roll is a simple and frequently used hose roll. 1 of the couplings forms the core and the other the outside of roll
- The single donut hose roll is used when the hose will be put into use directly from the rolled state.
  - The hose has both couplings on the outside of the roll. the Appox. middle makes up the core
  - The female coupling overlaps the male, protecting it.

Rolling a straight roll

Step 1: Lay the length of hose to be rolled flat and straight.

Step 2: Begin by folding the male coupling over on top of the hose.

Rolling a straight roll

Step 3: Roll the hose to the female coupling..

Step 4: Set the hose roll on its side and tap any protruding hose flat with a foot.

Performing a Single Donut Roll

Step 1: Place the hose flat and in a straight line.

Step 2: Locate the mid-point of the hose.

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Finishing a Single Donut Roll

Step 3: From the mid-point, move 5' toward the male coupling end. Start rolling the hose toward the female coupling.

Step 4: At the end of the roll, wrap the excess hose of the female end over the male coupling to protect the threads.

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Twin donut rolls

- The twin donut hose roll is used primarily to make a small compact roll that can be carried.
  - The self-locking twin donut hose roll is similar to the twin donut, with the exception that it forms its own carry loop.

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Performing the Twin Donut Roll

Step 1: Lay the hose flat and in a straight line.

Step 2: Bring the male coupling alongside the female coupling.

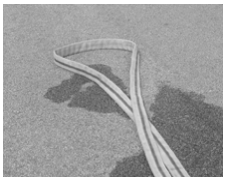
Finishing the Twin Donut Roll

Step 3: Fold the far end over and roll toward the couplings, creating a double roll.

Step 4: The roll can be carried by hand, rope, or strap.

Performing a Self-Locking Twin Donut

Step 1: Lay the hose flat and bring the coupling alongside each other.



Step 2: Move one side of the hose over the other creating a loop. This loop creates the carrying shoulder loop.

Performing a Self-Locking Twin Donut

Step 3: Bring the loop back toward the couplings to the point where the hose crosses.

Step 4: From the point where the hose crosses, begin to roll the hose toward the couplings with the loop as its center. This creates a loop on each side of the roll.

Performing a Self-Locking Twin Donut

Step 5: On completion of the rolling, position the couplings on the top of the rolls.

Step 6: Position the loops so one is larger than the other. Then pass the larger loop over the couplings and through the smaller loop.

Stop