



S-130 Unit 10: Water Use

Summary:

Regardless of what type of crew a FFT2 is working with, they will need to be proficient in the application of water use in fire suppression activities. This unit is intended to provide students with a basic knowledge of wildland fire water delivery methods, hose and hose appliances, and common hose lay configurations.

Incident Position Description (IPD) Alignment:

This unit aligns with the following FFT2 IPD specific duties

(<https://www.nwcg.gov/positions/fft2/position-ipd>):

- Perform engine operations duties including running the pump, deploying hose lays, and effectively using water and additives.
- Perform portable pump operator duties such as pump site selection, set up, and operation.
- Operate within your skill level and limitations.

Objectives:

Students will be able to:

- Demonstrate deploying the two common types of hose lays.
- Demonstrate different water spray patterns and describe when to use them.
- Discuss the proper setup and operation of a portable pump and responsibilities of the pump operator.
- Demonstrate the process of correctly unrolling and retrieving hose.
- Demonstrate deploying the two common types of hose lays.
- Demonstrate different water spray patterns and describe when to use them.



Unit at a Glance:

Topics	Method	Duration
Backpack Pump	Field Presentation	10 Minutes
Water Delivery Methods	Field Presentation	10 Minutes
Hose	Field Presentation	15 Minutes
Fittings and Connections	Field Presentation	15 Minutes
Hose Accessories	Field Presentation	10 Minutes
Nozzles	Field Presentation	10 Minutes
Hose Lays	Field Presentation	15 Minutes
Spray Patterns and Application	Field Presentation	15 Minutes
Care of Hose and Fittings	Field Presentation	10 Minutes
Total Unit Duration		1 Hour 50 Minutes

Materials:

- *Incident Response Pocket Guide (IRPG)*, PMS 461, <https://www.nwcg.gov/publications/461>.
- *Water Handling Equipment Guide*, PMS 447-1, <https://www.nwcg.gov/publications/447-1>.
- *NWCG Standards for Wildland Fire Resource Typing*, PMS 200, <https://www.nwcg.gov/publications/200>.
- The tools and equipment presented in the unit, as well as local area specific tools and equipment.
- Required fireline PPE.
- Notebook for participants.
- S-130 Student Evaluation Task Sheet.
- Ability to display images and video on large screen (if field presentation not possible).
- White board or easel access for group breakout (if field presentation not possible).

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Note to Instructor

- This unit is intended to be taught as a hands-on presentation in the field.
- The tools and equipment referenced should be available as props for instructors and hands on implements for students.
- If field presentation is not possible, the unit can be taught via the PowerPoint in a classroom, utilizing the tools and equipment as reference.
- Detailed information to aid instructor preparation is available in the *Water Handling Equipment Guide*, PMS 447-1, <https://www.nwcg.gov/publications/447-1>.

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Objectives

Students will be able to:

- Demonstrate deploying the two common types of hose lays.
- Demonstrate different water spray patterns and describe when to use them.
- Discuss the proper setup and operation of a portable pump and responsibilities of the pump operator.

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☐ Review unit objectives.

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Objectives

Students will be able to:

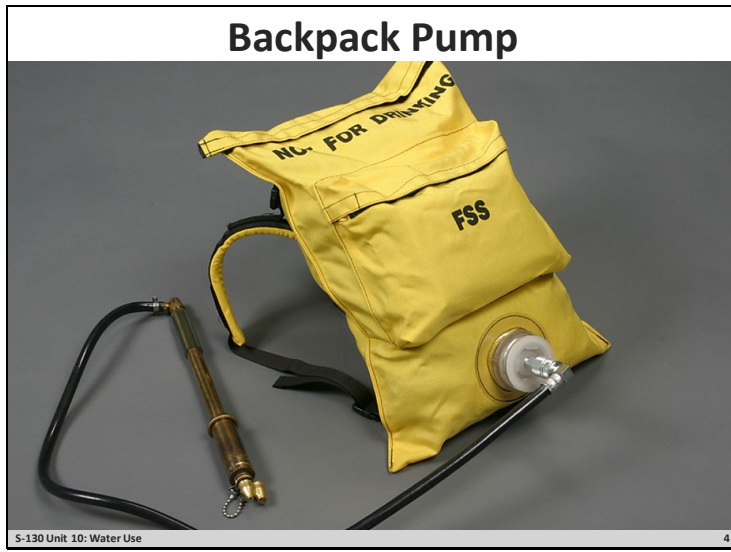
- Demonstrate the process of correctly unrolling and retrieving hose.
- Demonstrate deploying the two common types of hose lays.
- Demonstrate different water spray patterns and describe when to use them.

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☐ Review unit objectives.

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- Backpack Pump—A portable sprayer with hand-pump, fed from a liquid filled container fitted with straps, used mainly in fire and pest control.
 - The backpack pump, also known as a bladder bag, is a valuable tool used in many firefighting situations, but is particularly useful in hot spotting and mopup.
- ☐ Discuss the parts of the backpack pump:
- Five-gallon collapsible tank.
 - Shoulder straps.
 - Filler cap.
 - Flexible hose.
 - Suction check valve.
 - Trombone pump (including combination nozzle, handle, adjusting nut, barrel), and the trombone clip.

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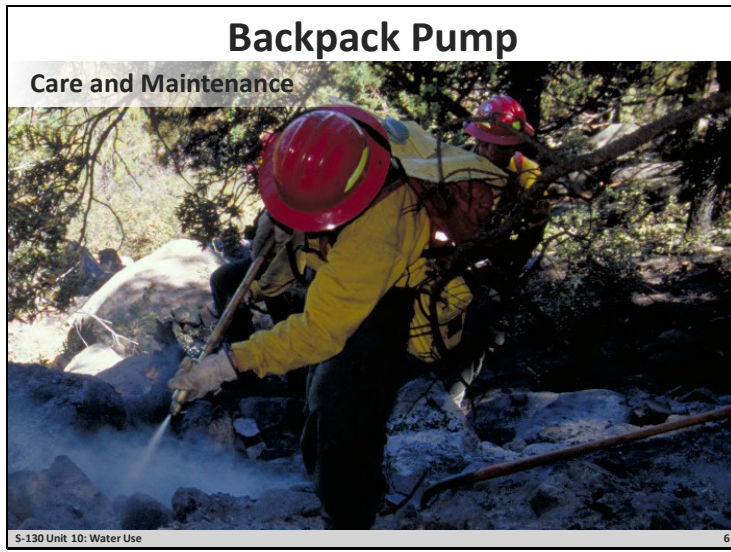
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- ☐ Discuss and demonstrate the proper use of the backpack pump including:
 - Lifting and wearing the backpack pump.
 - Maintaining good footing and balance.
 - Operating the trombone and changing the nozzle to produce fog or straight stream.
 - Directing streams in swinging motion parallel to the fire perimeter and at the base of the flame.
 - Refilling from a water source with clean water and how dirty water can clog the nozzle.

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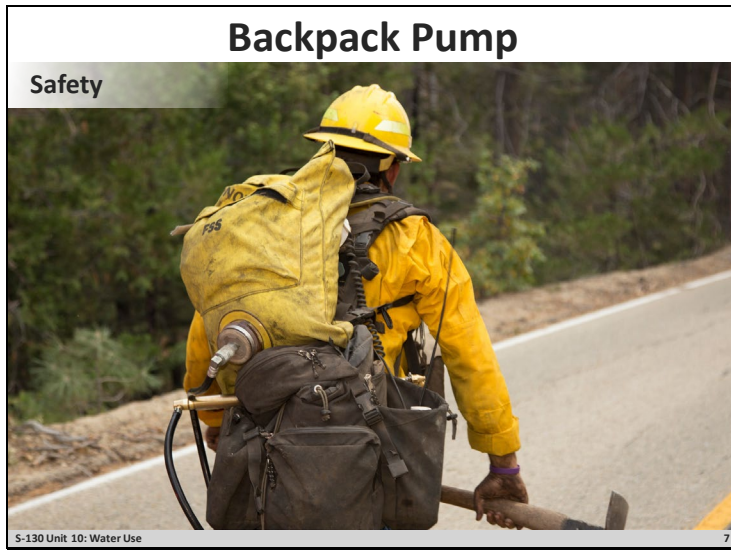
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- ☐ Discuss proper care, maintenance, and troubleshooting of the backpack pump:
 - Checking for water in the tank.
 - Checking for blockages in the nozzle, hose, and tank.
 - Using powdered graphite or non-oil lubricants on the trombone that will not collect dirt and grime.

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- ☐ Discuss safety concerns while using the backpack pump including:
 - Proper lifting technique.
 - Adjusting the straps to fit body frame.
 - Not climbing over obstacles while wearing the backpack pump.
 - Not using anything but water.

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Note to Instructor

If using an engine, tailor the instruction to the specific type available.

- ☐ Reference Engine ICS Typing in the *Incident Response Pocket Guide (IRPG)*, PMS 461, <https://www.nwcg.gov/publications/461>.
- ☐ Discuss the use of an Engine as a water delivery system:
 - Engine type.
 - Capabilities.
 - Capacity and limitations.
 - Pump and pump engine specifications.
 - Water resupply procedures.
- ☐ Discuss safety equipment in addition to required PPE that should be used during water delivery methods:
 - Ear plugs should be used by the pump operator.
 - Eye protection should be used by the nozzle operator.

Note to Instructor

Detailed information to aid instructor preparation and facilitation is available in the *NWCG Standards for Wildland Fire Resource Typing*, PMS 200, <https://www.nwcg.gov/publications/200>.

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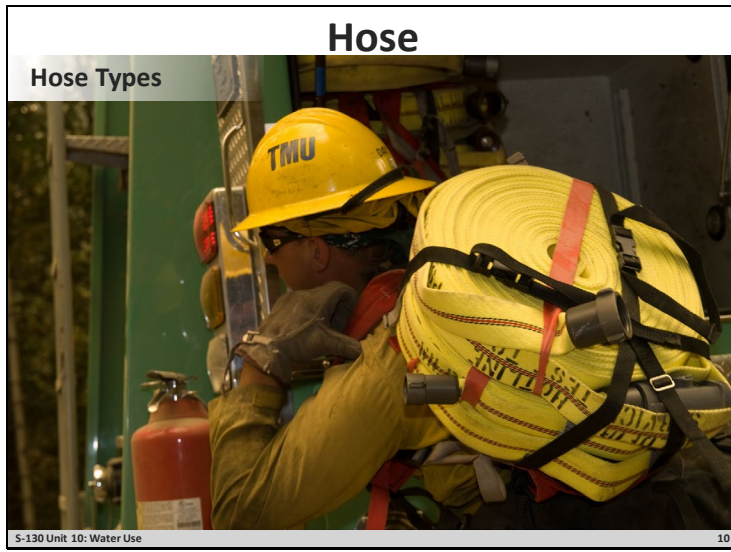
Note to Instructor

If using portable pumps, tailor the instruction to the specific type available.

- ☐ Reference High Pressure Pump Information in the *Incident Response Pocket Guide (IRPG)*, PMS 461, <https://www.nwcg.gov/publications/461>.
- ☐ Discuss the use of portable pumps as a water delivery system:
 - Pump type.
 - Capabilities.
 - Limitations.
 - Pump and pump engine specifications.
 - Set up procedures.
 - Starting procedures.
- ☐ Discuss safety equipment in addition to required PPE that should be used during water delivery methods:
 - Ear plugs should be used by the pump operator.
 - Eye protection should be used by the nozzle operator.

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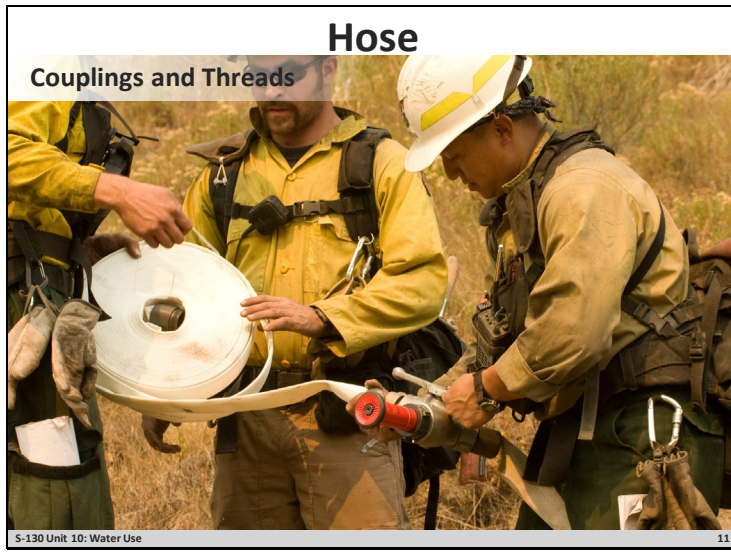
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- ☐ Discuss the various types of hose:
 - Synthetic lightweight lined type 1 hose (most common in wildland fire).
 - Abrasion resistant synthetic lightweight lined type 2 hose (often yellow).
 - Cotton-synthetic jacket, rubber lined.
 - High pressure.
 - Linen or unlined.
 - Suction.
- ☐ Discuss standard wildland fire hose sizes:
 - 3/4 inch (also known as garden, toy, or pencil hose).
 - 1 inch.
 - 1 1/2 inch.
- ☐ Discuss common lengths:
 - 50 feet.
 - 100 feet.

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- ☐ Discuss variations of standard threaded couplings:
 - Rocker lug.
 - Pin lug.
 - Quick connect (quarter-turn).
 - Each length of hose has two couplings or connectors, one female and one male.
- ☐ Discuss the three thread types that are universally used:
 - National Pipe Straight Hose (NPSH).
 - National Hose (NH).
 - Garden Hose (NH, also called GHT).
 - Thread types can vary based on local use.
- ☐ Discuss the difference between NPSH and NH hose thread:
 - Same threads per inch.
 - NPSH hose threads do not taper allowing the female coupling on NPSH hose to thread onto a NH fitting.

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- ☐ Discuss the common ways hose is stored for use:
 - Rolls – single or double, advantages and disadvantages.
 - On reels – usually for high pressure hose.
 - In baskets or trays – used on engines to store hose.
 - In packs – usually a backpack (hose pack) carried by the firefighter (prepackaged and preconnected).
- ☐ Discuss how to properly roll and unroll hose:
 - Unroll so the female end always points towards the water source and the male end points toward the fire or target.
 - Remove and store ties for after use (string, rubber band, etc.).
 - Remove air.
 - Protect the male end threads when rolling.

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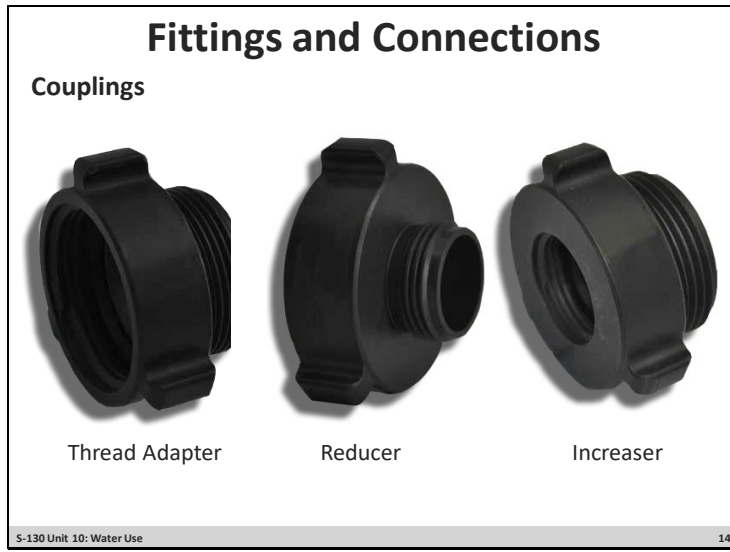
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Fittings and Connections



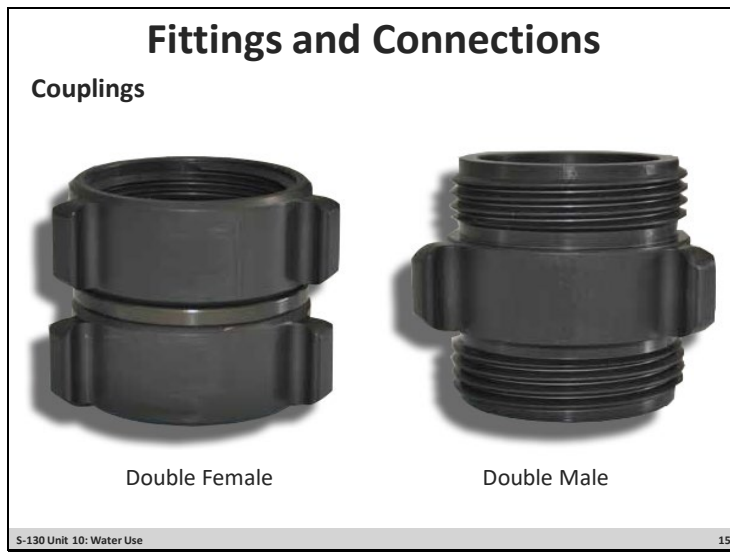
- Deploying hose further than 50 to 100 feet requires fittings and connections.

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- ☐ Discuss the use and purpose for the three main couplings:
 - Thread adapter – used to connect hoses together that have different thread types.
 - Reducer – used to reduce from a larger diameter to a smaller diameter.
 - Increaser – used to increase from a smaller diameter to a larger diameter.
- ☐ Discuss examples of when these couplings would be used.

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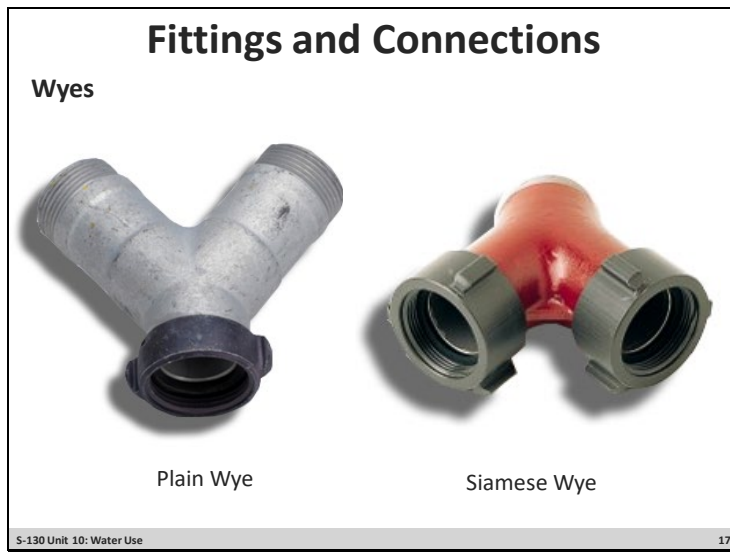
- ☐ Describe the purpose of the two types of couplings:
 - Double female – used to connect two male ends of hose or fittings.
 - Double male – used to connect two female ends of hose or fittings.

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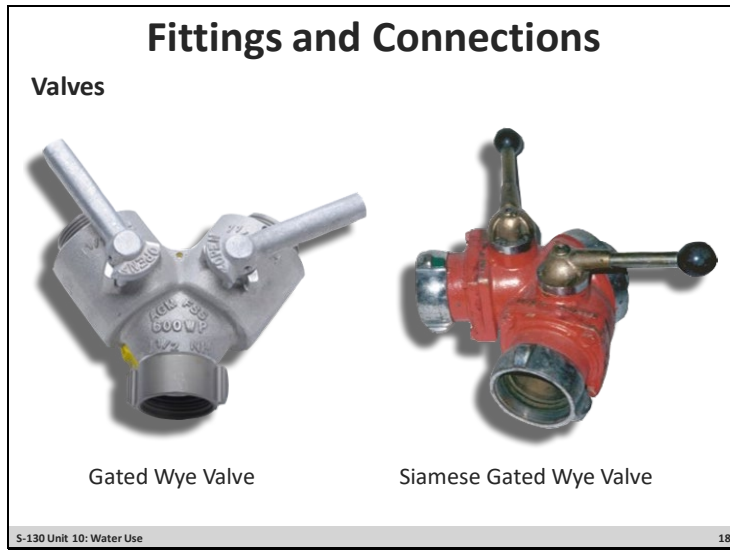
- ☐ Discuss the use of branching a lateral supply hose off a main (trunk) line.
- ☐ Discuss variations in the hose in-line tee:
 - With cap.
 - With shut-off valve.

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- ☐ Discuss the purpose of the plain wye:
 - Used to divide a single line into two lines.
- ☐ Discuss the purpose of the siamese wye:
 - Used to combine two lines into a single line.

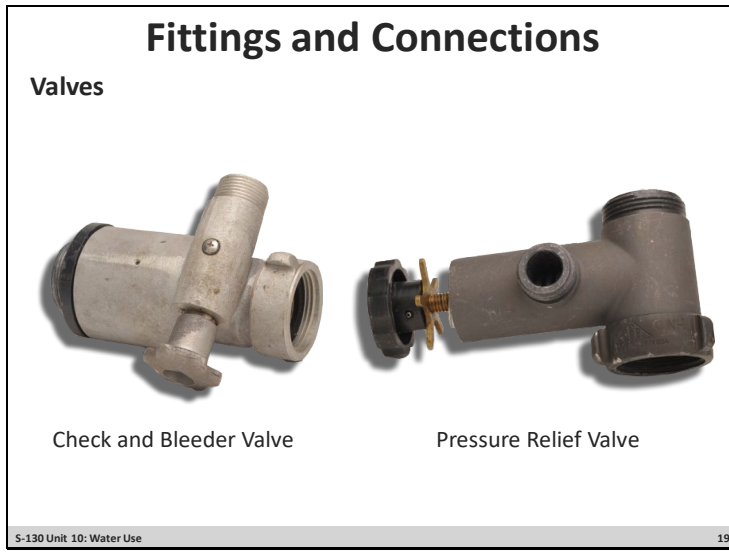
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- ☐ Discuss the purpose of the gated wye valve:
 - Used to divide single line into two lines with the ability to open/close valves on either line.
- ☐ Discuss the purpose of the siamese gated wye valve:
 - Used to combine two lines into a single line with the ability to open/close valves on either line.

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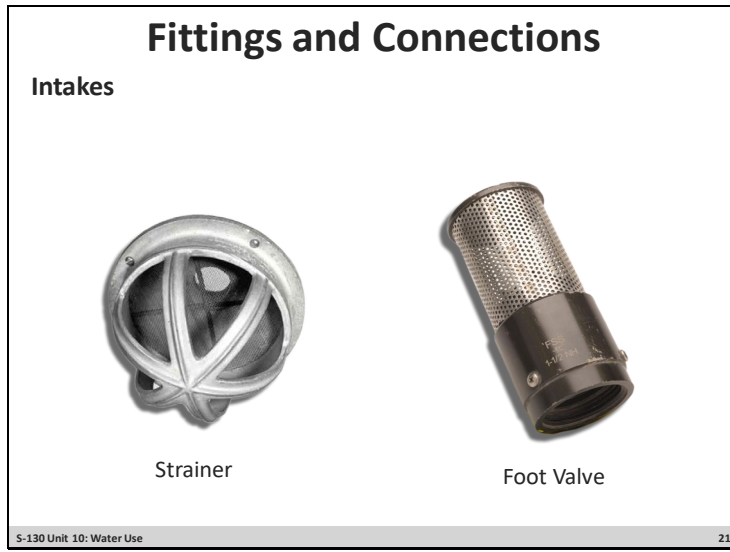
- ☐ Discuss check and bleeder valve:
 - A combination valve and one-way water check.
 - Used to keep water flowing back into the pump when the pump stops, and to relieve pressure on the pump when it is restarted.
- ☐ Discuss pressure relief valve:
 - A spring-loaded, adjustable valve placed between the pump and the discharge hose.
 - Used to release excess pressure on the pump due to kinks or nozzle shut-off.

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- ☐ Discuss ball valve:
 - Used in the main hose line to shut off water.
 - Enables person holding nozzle to stop water flow without shutting off the pump.
 - Can be used to restrict downhill head pressure.

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- ☐ Discuss the purpose of the strainer:
 - Used on the intake/draft line to keep debris from entering the pumping system.
- ☐ Discuss foot valve:
 - Strainer combined with a one-way spring or swing (flapper).
 - Used to prevent water backflow into the pump.

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Knowledge Check	
Eye protection should be worn by nozzle operators.	
<p>True or False?</p> <p>True.</p> <p>To prevent eye damage from blowback of superheated material.</p>	
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Question: Eye protection should be worn by nozzle operators. True or False?

Answer: True. To prevent eye damage from blowback of superheated material.

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- Firefighters performing water delivery responsibilities will need to be familiar with hose accessories to do their job safely and to effectively provide water to the fire.

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Hose Accessories

Hose Shut off Clamp

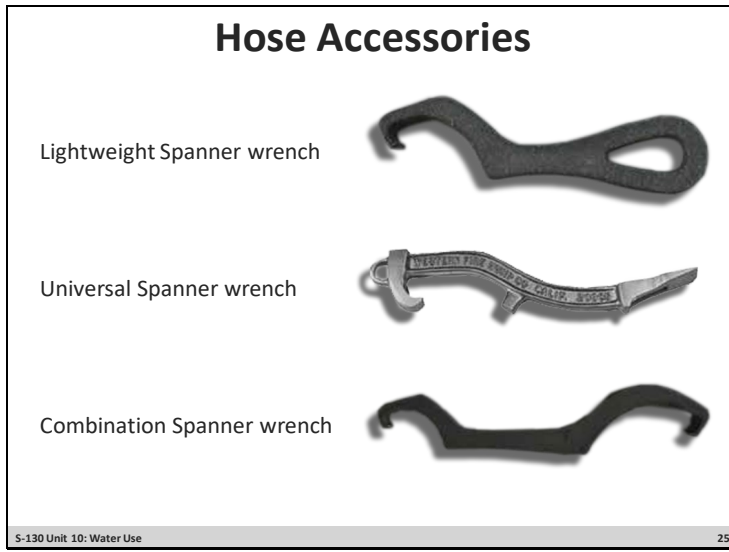


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- ☐ Discuss the purpose of the hose shut-off clamp:
 - Used to stop the flow of water in a hose line.
 - Used to prevent the loss of water when a fire hose bursts.
 - Allows rapid change of nozzles, hoses or fittings.
 - Can be used with an insert at pinch point (as seen in the image) to increase friction and prevent the clamp from slipping.

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- ❑ Discuss the spanner wrench use with hose and fittings:
 - Used to tighten or loosen hose connections by grabbing onto the lugs of the female end connector.
 - Come in various sizes depending on the required connection size.
 - Lightweight spanner is usually best for 1 inch to 1 1/2-inch diameter.
 - Universal spanner can fit most adapters 3/4 inch to 3-inch diameter.
 - Combination spanner can fit lugged adapters 1 inch to 2 1/2-inch diameter.

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- ☐ Discuss the gravity sock:
- Used in the absence of other common water delivery methods to take advantage of flowing water from a source above the fire.
 - The mouth (large end) is placed in a stream and anchored securely.
 - The tail (small end) is attached to the fire hose.

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- ☐ Discuss the purpose of hose plugs and caps:
 - Provide thread protection.
 - Used to close off specific pieces of hose or accessories when not in use.
 - Caps cover male threads.
 - Plugs thread into and protect female threads.

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- The female end of adapters, reducers, increasers, connectors, and caps all benefit from the use of washers and gaskets.
- ☐ Discuss the advantages of washers and gaskets:
 - Prevent leaks and loss of pump prime.
 - Provide a tighter, more complete seal.
- ☐ Discuss the importance of maintaining the condition of washers and gaskets:
 - Replace when dry, cracked, or missing.

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- Firefighters should understand the different types and capabilities of nozzles and how they are used to control the distribution of water.

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- ☐ Discuss features of the forester (twin tip) nozzle:
 - 1-inch connection.
 - Can be switched easily from straight stream pattern to fog-spray pattern.

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- ❑ Discuss features of the adjustable barrel nozzle:
 - Available in 3/4 inch, 1 inch, and 1 1/2 inch.
 - Water (spray) pattern is adjusted by turning the barrel of the nozzle.
 - Some adjustable nozzles have a shut-off valve attached with adjustable spray pattern as well as selectable gallonage functions.
 - Manufactured in different materials, such as brass, aluminum, and plastic.

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Hose Lays

Arrangement of connected lengths of fire hose and accessories on the ground, beginning at the first pumping unit and ending at the point of water delivery.



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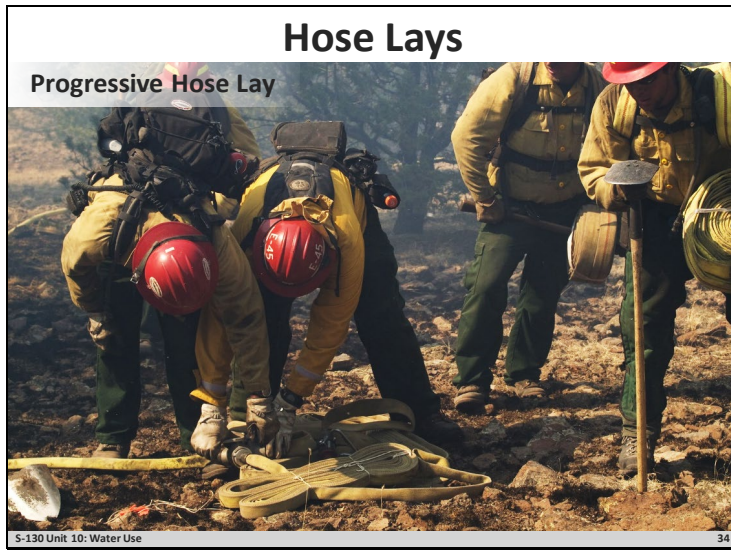
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- ☐ Discuss simple hose lay:
 - Consists of consecutively coupled hoses without laterals.
 - The nozzle regulates water flow and the water application method.
 - Very few fittings are used.
- ☐ Discuss and demonstrate the process of adding additional lengths of hose to a simple hose lay.
- ☐ Discuss safety concerns related to a simple hose lay:
 - Lacks provisions for safety should the fireline be compromised behind the nozzle operator.
 - Requires access to a separate protection line when adding additional lengths.

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- ☐ Discuss progressive hose lays:
 - Consists of a series of lateral lines off a main trunk line.
 - Designed for speed and safety in direct attack where mobile attack with an engine is not possible.
 - Very effective during mop up operations.
- ☐ Discuss and demonstrate the process of adding additional lengths of hose to a progressive hose lay.
- ☐ Discuss the advantages of the progressive hose lay:
 - Provides for continuous attack without shutting down the pump or water supply.
 - Provides a margin of safety since water is available behind the lead nozzle operator.
 - Provides numerous opportunities for lateral lines to speed up mopup.

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- Choosing the proper spray pattern and application conserves water and allows firefighters to be more efficient, saving them time and energy.

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- ☐ Discuss why straight stream spray pattern is used:
 - A lot of pressure is needed to reach a distance.
 - Targets cannot be reached with a fog spray.
 - Ground and surface fuels need to be dug out during mopup.
 - Uses more water than other spray pattern applications.
- ☐ Discuss situations when straight stream spray pattern is used:
 - Fire is too hot to get close to (excessive flame lengths and rate of spread).
 - Fire is confined to a small area.

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- ☐ Discuss why fog spray pattern is used:
 - Provides the most personal protection for firefighters.
 - Close work is possible.
 - Fire covers a large area.
 - A smaller volume of water is needed to put out the fire.
 - Water conservation is necessary.
- ☐ Discuss situations when fog spray pattern is used:
 - Hot spotting.
 - Building a wet line.
 - Direct attack.
 - Mopup.

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- ☐ Discuss the following considerations for water application:
 - Direct the fog spray parallel to the edge at the base of the flames.
 - Aim accurately and maintain water stream in a sweeping motion.
 - Avoid excessive use of water and pressure when conservation is prudent.
 - High pressure will deliver air as well as water to the fire and can fan the flame rather than knock it down, while low pressure may not penetrate to the base of the flames.
 - Fire edges that have been knocked down with water may reignite if not completely extinguished.
 - Follow up water with mechanized or hand line as soon as possible, especially in heavy fuels.

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- ☐ Discuss proper maintenance and care of hose, fittings, and accessories to extend equipment life:
 - Rolling hose to protect exposed threads.
 - Replacing protective caps on accessories and male hose ends.
 - Making sure female ends have correct gasket size.
 - Draining water from hose.
 - Breaking down hose lay when using figure-8 or butterfly to break down hose lay, ensure male and female ends are connected to protect.

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Knowledge Check

Based on the image below, what spray pattern is being used?

Answer:

Straight Stream



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Question: Based on the image below, what spray pattern is being used?

Answer: Straight Stream

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Knowledge Check

What are the two common types of hose lays?

Answer:

Simple and Progressive



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Question: What are the two common types of hose lays?

Answer: Simple and Progressive

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Objectives
<p>Students will be able to:</p> <ul style="list-style-type: none">• Demonstrate the operation and maintenance of a backpack pump.• Identify commonly used fittings/appliances and hose components, and their proper care.• Discuss the proper setup and operation of a portable pump and responsibilities of the pump operator.
<small>S-130 Unit 10: Water Use 42</small>

☐ Review unit objectives.

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Objectives
<p>Students will be able to:</p> <ul style="list-style-type: none">• Demonstrate the process of correctly unrolling and retrieving hose.• Demonstrate deploying the two common types of hose lays.• Demonstrate different water spray patterns and describe when to use them.
<small>S-130 Unit 10: Water Use 43</small>

☐ Review unit objectives.