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| **TEXAS CTE LESSON PLAN**[www.txcte.org](http://www.txcte.org) |
| **Lesson Identification and TEKS Addressed** |
| **Career Cluster** | Law, Public Safety, Corrections, & Security |
| **Course Name** | Firefighter II |
| **Lesson/Unit Title** | Fire Service Hoses |
| **TEKS Student Expectations** | **130.335. (c) Knowledge and Skills**(6) The student describes the purpose of the National Fire Protection Association standards applicable to fire service hoses and reviews the procedures for care, maintenance, and inspection of fire hoses, couplings, nozzles, and water valves (A) The student is expected to identify and describe the use and construction of fire hoses and couplings(B) The student is expected to explain the application of each size and type of hose on a pumper as required to be carried by National Fire Protection Association 1901(C) The student is expected to demonstrate the methods of connecting fire hose couplings |
| **Basic Direct Teach Lesson**(Includes Special Education Modifications/Accommodations and one English Language Proficiency Standards (ELPS) Strategy) |
| **Instructional Objectives** | The student will be able to:1. Describe hose types and their construction2. Describe the differences between an attack hose and a supply hose3. Practice the methods of attaching couplings to a fire hose4. Identify the NFPA requirements for fire service hoses on pumping apparatus |
| **Rationale** | It is necessary for firefighters to understand the safe operation and use of fire service hoses. To fight fire effectively, it is mandatory that they understand what type of hose to use, when and how to deploy hose lines, and how to effectively use a hose at a fire scene. Since they are designed to move water to the fire scene, failing to learn the capabilities and limitations of fire hoses could have severe consequences. |
| **Duration of Lesson** | 12 hours |
| **Word Wall/Key Vocabulary***(ELPS c1a,c,f; c2b; c3a,b,d; c4c; c5b) PDAS II(5)* |  |
| **Materials/Specialized Equipment Needed** | * Hose tools, appliances, hose, and hydrant
* Presentation materials and/or computer-based presentation software
* Computers with Internet Access
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| **Anticipatory Set**(May include pre-assessment for prior knowledge) | Discuss with students the importance of understanding the use of fire hoses as a tool in the fire service. Not knowing what types of hoses, handlines, carries, and lays to use at a fire scene can drastically change the outcome of a fire emergency. Something that seems as ordinary as a fire hose can be lethal if not fully understood. Understanding its safe use and how to handle it properly is vital to a firefighter’s success. Use the Discussion Rubric for assessment. |
| **Direct Instruction \*** | 1. General Information
	1. Fire hoses are manufactured in different diameters, each for a specific use
		1. Usually cut and coupled in lengths of 50 or 100 feet, but longer lengths are available
		2. Referred to as lengths or sections
	2. Intake hose – used to connect fire apparatus to a water source
		1. Soft intake hose
			1. Sometimes referred to as a soft sleeve hose
			2. Used to transfer water from a pressurized source to the pump intake
			3. Available in sizes from 2½ inches to 6 inches in diameter
		2. Hard intake hose – primarily used to draft water from a static source
			1. Sometimes referred to as a hard-suction hose
			2. Can be used to siphon water from one portable tank to another in water shuffle operations
			3. Has a steel core (helix) to prevent it from collapsing when drafting
			4. Available in sizes from 2½ inches to 6 inches in diameter
	3. National Fire Protection Agency (NFPA) Standards related to hoses
		1. Standard on Fire Hose (NFPA 1961) lists specifications for fire hoses.
		2. Standard for Fire Hose Connections (NFPA 1963) lists specifications for fire hose couplings and threads
		3. Standard for Automotive Fire Apparatus (NFPA 1901)
			1. Requires pumpers to carry:
				1. 15 feet of large soft intake hose or 20 feet of hard intake hose
				2. 800 feet of 2½-inch or larger fire hose
				3. 400 feet of 1½-, 1¾-, or 2-inch attack hose
			2. The lengths and sizes may be increased, depending on departmental needs.
2. Fire Hose Damage
	1. Mechanical damage
		1. Covering damage
			1. Rips
			2. Slices
			3. Abrasions
		2. Crushed or damaged couplings
		3. Cracked inner linings
		4. Damage prevention
			1. Don’t pull over rough or sharp edges or objects.
			2. Use hose ramps (bridges) to protect hoses from being run over.
			3. Open and close nozzles, valves, and hydrants slowly
			4. Change fold positions when reloading hoses on apparatus
			5. Use chafing blocks to prevent abrasions when a hose vibrates at or near the pumper
			6. Avoid excessive pump pressure on the hose lines
	2. Thermal damage
		1. Caused by
			1. Excessive heat
			2. Direct contact
			3. Direct sunlight
		2. Damage prevention
			1. Protect hoses from exposure to excessive heat
			2. Don’t allow hoses to remain in a heated area once dry
			3. Use moderate temperatures for mechanical drying (warm air is much better than hot air)
			4. Keep the outsides of woven-jacket hoses dry when not in use
			5. To keep the liner soft, run water through a hose that has not been used
			6. To keep the liner from drying out, roll dry hoses in a straight line for storage
			7. Prevent hoses from encountering vehicle exhaust
			8. Use hose bed covers on apparatus to protect hoses from the sun
	3. Organic damage
		1. Woven jacket hoses (cotton or other natural fibers) are subject to:
			1. Mildew
			2. Mold
		2. Damage prevention
			1. Don’t keep wet hoses loaded on apparatus
			2. Inspect, wash, and dry hoses that have been contaminated.
			3. Remove, inspect, sweep, and reload hoses that have not been unloaded from apparatus for 6 months
			4. Make sure hoses are folded at different points when reloaded
			5. Inspect and test hoses annually, and after possible damage
	4. Chemical damage
		1. Some chemicals and chemical vapors can damage the outer jacket and/or cause the rubber lining to separate from the inner jacket
		2. Some products may weaken a hose to the point where it can burst under pressure:
			1. Paints
			2. Acids
			3. Petroleum-based
			4. Alkalis
		3. Runoff water may also contain contaminant that can damage hoses.
		4. Damage control
			1. Scrub hoses thoroughly, and brush off traces of acid contact with a solution of baking soda and water (baking soda neutralizes acids)
			2. Periodically remove hoses from apparatus, wash them with plain water, and let them dry
			3. Test hoses if you suspect damage
			4. Don’t lay hoses in gutters or next to the curb where vehicles park; there may be an accumulation of oil or acid from car batteries
			5. Dispose of hoses according to department Standards Operating Procedures (SOPs) if they cannot be decontaminated
3. Care and Maintenance
	1. Washing hose – the method is dependent upon its type
		1. Rinse the following hose types with clear water and use mild soap if necessary:
			1. Hard rubber booster hose
			2. Hard intake hose
			3. Rubber jacket collapsible hose
		2. Woven jacket hose
			1. Dust and dirt should be thoroughly brushed and swept
			2. If the dirt can’t be removed, wash and scrub it with clear water and a brush
		3. When a hose has been exposed to oil
			1. Wash it with a mild soap or detergent, using a common scrub brush or straw broom, and a stream of water from a garden hose
			2. Once the oil is removed, rinse it thoroughly with clear water.
		4. Hose washing machines
			1. The most common type washes hoses up to 3 inches in diameter
			2. The flow of water can be adjusted; the movement of water assists in propelling the hose through the machine
			3. The hose-line can be connected to the pumper or to a hydrant directly; the higher the water pressure, the better the results
		5. Cabinet-type machines
			1. Wash, rinse, and drain fire hoses
			2. Designed to be used in the station
			3. Can be operated by one person, and can be used with or without detergent
	2. Drying hoses
		1. Fire hoses should be dried before being stored
		2. Woven jacket hoses should be dried before being put back on the apparatus
		3. The methods used to dry hoses depend on the hose type
		4. Hoses should be dried according to department SOPs and the manufacturer’s specifications
		5. The following hose types may be put back on the apparatus while wet:
			1. Hard rubber booster hose
			2. Hard intake hose
			3. Synthetic jacket collapsible hose
	3. Storing hoses
		1. After a hose is brushed, washed, and dried, it should be rolled and stored in its rack, unless it is to be placed back on the apparatus
		2. Hose racks should be in clean, ventilated rooms or close to the apparatus room for easy access
		3. Racks can be freestanding or mounted on a wall
		4. Mobile hose racks can be used to store and move hoses from storage rooms to the apparatus for loading
4. Fire Hose Couplings
	1. Coupling types
		1. Threaded couplings – male or female couplings with spiral threads, either three- or five-piece type
		2. Nonthreaded couplings – couplings with no male or female components that are also called Storz Couplings, or sexless couplings; commonly found on large-diameter hoses
	2. Coupling construction
		1. Shank – the portion of the coupling that serves as a point of attachment to the hose
		2. Higbee cut – a special cut at the beginning of the thread on a hose coupling that clearly identifies the first thread to eliminate cross-threading
		3. Higbee indicator – notches or grooves cut into coupling lugs to identify, by touch or sight, the exact location of the Higbee Cut
		4. Lugs – aid in tightening and loosening the couplings. There are three types:
			1. Pin – uncommon because they tend to snag when a hose is dragged
			2. Rocker – most new threaded couplings have rounded rocker lugs
			3. Recessed – a booster hose normally has couplings with recessed lugs
		5. Swivel gasket – used to make the connection watertight when female and male ends are connected
		6. Expansion-ring gasket – used at the end of the hose where it is expanded into the shank of the coupling
5. Coupling Care Rules
	1. Avoid dropping and/or dragging couplings
	2. Keep vehicles from running over hose couplings
	3. Inspect couplings when a hose is washed and dried
	4. Remove the swivel gasket and twist the swivel in warm, soapy water
	5. Clean the threads to remove tar, dirt, gravel, and oil
	6. Inspect the gasket and replace it if it is cracked or creased
6. Hose Appliances – water travels through these
	1. Valves – the flow of water is controlled with various valves:
		1. Ball valves – used in pumper discharges and gated wyes
		2. Gate valves – used to control the flow from a hydrant
		3. Butterfly valves – used on large pump intakes and have a flat baffle that turns 90 degrees; most operate by a ¼-turn handle
		4. Clapper valves – used in siamese appliances, and in some pump piping; they allow water to flow in only one direction. The clapper is a flat disk, hinged at the top or on one side, that swings in a door-like manner
	2. Valve devices – allow the number of hose-lines to be increased or decreased; used in wye appliances, siamese appliances, water thief appliances, large diameter hose appliances, and hydrant valves
		1. Wye appliance – one female inlet and two or more male outlets that are usually smaller than the inlet; the outlets are usually gated
		2. Siamese appliance – combines two or more hose-lines into one; generally have female inlets and one male outlet. These are commonly used to supply the hose leading to a ladder pipe
		3. Water thief appliance – like wye appliances and most often used in wildland fire fighting. The most common type has a 1½-inch female inlet, a 1½-inch male outlet, and one valve-controlled 1-inch male outlet. Large volume water thieves consist of a large diameter hose (LDH) inlet and two or more 2½-inch valve-controlled male outlets
		4. Large-diameter hose appliance – typically one LDH inlet and three 2½-inch valve-controlled male outlets. Sometimes called
			1. Portable hydrants
			2. Phantom pumpers
			3. Large diameter distributors
		5. Hydrant valve – a typical four-way hydrant valve used to provide increased pressure from low-pressure hydrants
	3. Fittings are devices that facilitate the connection of hose-lines of different sizes to provide an uninterrupted flow of water
		1. Adapters – fittings for connecting hose couplings with dissimilar threads but the same inside diameter
		2. Reducer – an adapter used to attach a smaller hose to a larger hose. The female end has the larger threads, while the male end has the smaller threads
		3. Double male and double female adapters – used to connect similar types of hose couplings together
		4. In some areas, hydrants are equipped with sexless adapters on the main discharge (steamer connection)
		5. Elbow adapter – reduces stress on the hose connected to the pump and prevents kinks in the hose; elbows may be permanently attached to pump intakes or discharges
	4. Intake Devices
		1. Intake strainers keep debris from entering the pump
		2. Floating strainers keep the hard intake hose away from the bottom and reduce the amount of debris that may clog the strainer
7. Hose Tools – water does not travel through hose tools
	1. Hose rollers – prevent mechanical damage to hose-lines that cross windowsills or wall parapets
	2. Hose jackets – can be used or applied to a hose to temporarily repair a rupture or leak in an emergency
		1. Two sizes – 2½ and 3 inches
		2. Can also connect mismatched or damaged screw thread couplings
	3. Hose clamps
		1. Three types:
			1. Screw down
			2. Press down
			3. Hydraulic press
		2. All are used to stop the flow of water in a hose-line for the following reasons:
			1. To prevent charging a hose-line
			2. To replace burst sections of hose
			3. To extend a hose-line
			4. To advance a charged hose-line up stairs
		3. General rules for applying hose clamps:
			1. Apply at least 20 feet behind apparatus
			2. Apply within 5 feet of the coupling on the incoming water side
			3. Center the hose evenly in the jaws to avoid pinching the hose
			4. Close and open the hose clamp slowly to avoid causing a water hammer
			5. Stand to one side when applying or releasing any type of hose clamp (the operating handle or frame can snap open suddenly)
	4. Hydrant wrench, spanner, and rubber mallet
		1. Hydrant wrench – primarily used to remove caps from hydrant outlets and to open hydrant valves
		2. Spanner –used primarily to tighten or loosen couplings
		3. Rubber mallet – used to tighten or loosen intake hose couplings; helps get an airtight connection at the pump
	5. Hose bridges (ramps) – designed to permit the movement of traffic over a hose while protecting the hose from damage
	6. Chafing blocks – prevent abrasions to hose jackets at points of contact with the ground where pump or water vibrations are likely
	7. Hose strap, hose rope, and hose chain
		1. Hose straps – can be used to reduce stress on the nozzle operator and improve the mobility of a charged hose-line
		2. Hose ropes and chains – can be used to carry and pull a fire hose, but are used to provide a secure means to handle pressurized hose-lines; they can also be used to secure a hose to ladders and other fixed objects
8. Common Hose Rolls
	1. Straight roll – consists of the male coupling at the center of the roll and the female end on the outside; used for the following situations:
		1. When loaded back on the apparatus at the fire scene
		2. When returning hose to the station for washing
		3. When placing the hose in rack storage
		4. For easy loading of the minuteman load
	2. Donut roll – the couplings are on the outside of the roll, within 12 inches of each other, and the male coupling is protected by the last layer of the roll
		1. Gives firefighters control of both couplings, while protecting them from damage
		2. The hose deploys out with fewer twists and kinks.
		3. Facilitates connecting to other couplings
		4. Can be performed by one or two firefighters
	3. Twin donut roll – creates a compact roll that can be easily transported
		1. Works well on 1½- and 1¾-inch hoses, but 2-, 2½-, and 3-inch hoses can be rolled in this manner as well
		2. Offsetting the couplings by about 1 foot at the beginning of the roll allows for the couplings to be coupled after the roll is tied or strapped. This is convenient for carrying
	4. Self-locking twin donut roll – provides a built in carrying strap
9. Hose Loads and Finishes
	1. Related information
		1. Hose bed – the main hose-carrying area of a pumper or other piece of apparatus designed to carry hoses
		2. Finish – the arrangement of the hose, usually placed on top of a hose load and connected to the end of the load; also called a hose load finish
	2. Hose loading guidelines
		1. Check gaskets and swivels before connecting any couplings
		2. Keep the flat sides of the hose on the same plane when connecting; the lugs do not need to be aligned
		3. Hand tighten the couplings; never use wrenches or excessive force
		4. Remove kinks and twists from fire hoses, then bend them to form a loop in the hose bed
		5. Make a Dutchman when you need to change the direction or location of a coupling
		6. Load LDH (3½ inches or larger) with all couplings near the front of the bed to save space and allow the hose to lie flat
		7. Do not pack hose too tightly
	3. Common hose loads
		1. Accordion load – the arrangement of a fire hose in a hose bed with the hose on edge and the folds adjacent to each other
		2. Horseshoe load – the arrangement of a fire hose in a hose bed in which the hose lies on its edge in the form of a horseshoe
		3. Flat load – the arrangement of a fire hose in a hose bed in which the hose lies flat in successive layers, one upon the other
	4. Hose load finishes
		1. Two categories
			1. For forward lays (straight finish)
			2. For reverse lays (reverse horseshoe and skid load finishes)
		2. Straight finish – consists of the last section of a hose, folded across the hose bay
		3. Reverse horseshoe finish
			1. Similar to the horseshoe load, except that the U portion of the horseshoe is at the rear of the bed
			2. It is made of one or two 100-foot lengths of hose, each connected to one side of a gated wye
			3. Any size of attack hose can be used
		4. Skid load finish
			1. Fold the last three lengths (150 feet) into a compact bundle on top of the rest of the load
			2. The load begins by forming three or more pull loops that extend beyond the end of the hose load
			3. The rest of the hose, with the nozzle attached, is accordion-folded across the hose used to form pull loops in the hose bed
10. Preconnected Hose Loads for Attack Lines
	1. Primarily used for attack lines
	2. Connected to discharge valves and placed away from the main hose bed
	3. Range from 50 to 250 feet long
	4. Carried in
		1. Longitudinal beds
		2. Raised trays
		3. Transverse beds (cross lays)
		4. Tailboard compartments
		5. Side compartments/bins
		6. Front bumper wells (jump lines)
		7. Reels
	5. Common preconnected loads
		1. Preconnected flat load – permits rapid deployment of an attack line. The loops at the end of the hose load are used for pulling either the entire load or a portion of it from the bed
		2. Minuteman load – designed to be pulled by and carried on the shoulder of one firefighter
		3. Triple layer load – requires that the entire load be unloaded before the nozzle end can be deployed
		4. Booster hose reels – located on the top of the apparatus or behind the front or rear bumper
11. Supply Hose Lays
	1. Forward lay – the hose extends from the water source to the fire scene. Hose loads that are intended for the forward lay have the female coupling loaded to come out of the hose bed first
	2. Reverse lay – used to extend the fire hose from the fire to the water source. The male coupling is usually located at the back of the hose bed in a reverse load. A nozzle or gated wye may be attached to the coupling
	3. Split lay – deployed by two pumpers, one making a forward lay and one making a reverse lay from the same point
12. Making and Breaking Hose Connections
	1. Foot-Tilt Method (one firefighter)
		1. Stand facing the two couplings
		2. Place a foot on the hose behind the male coupling
		3. Apply pressure to tilt it upward
		4. Grasp the female end by placing one hand behind the coupling and the other hand on the coupling swivel
		5. Bring both couplings together, and turn the swivel clockwise with your thumb
	2. Two-Firefighter Method
		1. Firefighter One
			1. Grasp the male coupling with both hands
			2. Bend the hose behind the coupling
			3. Hold the coupling and hose tightly against the upper thigh, or midsection, with the male threads pointed outward
		2. Firefighter Two
			1. Grasp the female coupling with both hands
			2. Bring the couplings together and align them
			3. Turn the female coupling counterclockwise until it clicks
			4. Turn the female swivel clockwise to complete the connection
	3. Knee-Press Method (Uncoupling)
		1. Grasp the hose behind the female coupling
		2. Stand the male coupling on end
		3. Set your feet well apart for balance
		4. Place one knee on the hose and shank of the female coupling
		5. Snap the swivel quickly in a counterclockwise direction while applying bodyweight to loosen the connection
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| **Guided Practice \*** | Tactile learning skills: Model one of the methods below for the students. Then have the students practice and demonstrate it. Repeat the process for the other methods. Use the appropriate checklists for additional instructions and assessment.* 1. Foot-Tilt Method Checklist
	2. Knee-Press Method Checklist
	3. Two Firefighter Method Checklist
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| **Independent Practice/Laboratory Experience/Differentiated Activities \*** | Have students research the classification of fire service hoses by use and construction. After researching the types, have them select one to present to the class. The presentation should include a visual aid (hand-made poster or computer-based presentation). This may be an independent, partner, or group activity. Use the Presentation Rubric for assessment. |
| **Lesson Closure** |  |
| **Summative/End of Lesson Assessment \***  | * Fire Hose Quiz and Key
* Foot-Tilt Method Checklist
* Knee-Press Method Checklist
* Two Firefighter Method Checklist
* Discussion Rubric
* Presentation Rubric
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| **References/Resources/****Teacher Preparation** | * ISBN: 0135151112, *Essentials of Firefighting* (5thEdition), International Fire Service Training Association (IFSTA).
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| **Additional Required Components** |
| **English Language Proficiency Standards (ELPS) Strategies** |  |
| **College and Career Readiness Connection[[1]](#footnote-1)** |  |
| **Recommended Strategies** |
| **Reading Strategies** |  |
| **Quotes** |  |
| **Multimedia/Visual Strategy****Presentation Slides + One Additional Technology Connection** |  |
| **Graphic Organizers/Handout** |  |
| **Writing Strategies****Journal Entries + 1 Additional Writing Strategy** |  |
| **Communication****90 Second Speech Topics** |  |
| **Other Essential Lesson Components** |
| **Enrichment Activity**(e.g., homework assignment) | For enrichment, students will participate in skills testing and practice using hose, hose tools, appliances, and a hydrant. |
| **Family/Community Connection** |  |
| **CTSO connection(s)** | SkillsUSA |
| **Service Learning Projects** |  |
| **Lesson Notes** |  |

1. Visit the Texas College and Career Readiness Standards at <http://www.thecb.state.tx.us/collegereadiness/CRS.pdf>, Texas Higher Education Coordinating Board (THECB), 2009. [↑](#footnote-ref-1)