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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 Stream and Line Selection  |
| **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 (H) The student is expected to describe the methods of washing and drying a fire hose(7) The student explains requirements to produce effective fire streams(A) The student is expected to identify, define, and demonstrate characteristics of fire streams(B) The student is expected to identify the type, design, operation, required nozzle pressure, and flow of a given selection of nozzles and tips(C) The student is expected to demonstrate the proper use of nozzles, hose appliances, water valves, adapters, and tools |
| **Basic Direct Teach Lesson**(Includes Special Education Modifications/Accommodations and one English Language Proficiency Standards (ELPS) Strategy) |
| **Instructional Objectives** | The student will be able to1. Define the characteristics of fire streams
2. Identify the type, design, operation, required nozzle pressure, and flow of a given selection of nozzles and tips
3. Describe the methods of washing and drying fire hoses
4. Demonstrate the proper use of nozzles, hose appliances, water valves, adapters, and tools
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| **Rationale** | For firefighters to effectively mitigate fire emergencies, it is important to understand the principles of fire extinguishment using water and available resources to determine fire stream and line selection. Firefighters must be able to determine what size line, what type of stream, and what volume of water to use to extinguish fire. Knowing when to make an aggressive interior offensive attack or to take a defense stand against a fire both require the knowledge necessary to effectively meet strategic priorities. Proper use of fire hose, nozzles, appliances, and tools can determine success at fire emergencies and other types of emergency responses. |
| **Duration of Lesson** | Teacher’s Discretion |
| **Word Wall/Key Vocabulary***(ELPS c1a,c,f; c2b; c3a,b,d; c4c; c5b) PDAS II(5)* |  |
| **Materials/Specialized Equipment Needed** | * Section(s) of hose
* Bristle brush
* Mild soap
* Bucket
* Water
* Nozzles
* Hose appliances
* Hose tools
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| **Anticipatory Set**(May include pre-assessment for prior knowledge) | Engage students in a discussion about the consequences of poor stream and line selection, and how those decisions can impact success on the fire ground. Address fire service tactical priorities (life safety, incident stabilization, and property conservation) and how stream selection and line selection are made relative to specific goals of an Incident Action Plan (IAP). Have each student research a fire or emergency response that may have faltered because of stream and or line selection, and then write what alternate choices might have made a difference had that decision been made differently. Use the Writing Rubric for assessment. |
| **Direct Instruction \*** | 1. Fire Stream Sizes
	1. Low volume streams
		1. Discharge less than forty gallons per minute (gpm)
		2. Commonly supplied by ¾-inch, 1-inch, or 1½-inch hose-lines
	2. Handlines
		1. Commonly supplied by a 1½-inch to 3-inch hose
		2. Discharge 40 to 350 gpm
	3. Master streams
		1. Discharge greater than 350 gpm
		2. Commonly supplied by a 2 ½-inch, 3-inch, or larger diameter hose
		3. Master streams are large volume streams

II. Fire Stream Types1. Solid streams
	1. The product of a fixed orifice, smooth bore nozzle
	2. Compact stream (little spray)
	3. Further reach than other stream types
	4. The reach is affected by
		1. Gravity
		2. Air and wind friction
	5. Solid handline streams operate at 50 pounds per square inch (psi)
	6. Solid master streams operate at 80 psi
2. Fog streams
	1. Have three settings
		1. Straight stream – resembles a solid stream, but is a product of a fog nozzle, and is not as compact as a solid stream
		2. Narrow fog – 15° to 45° pattern
		3. Wide fog – 45° to 80° pattern
	2. Commonly operate at 100 psi
	3. Reach is affected by
		1. Pattern selection
		2. Gravity
		3. Water velocity
		4. Friction with air
		5. Wind
	4. Have less reach than solid or straight streams
3. Broken streams
	1. Fire streams broken into coarse drops (the droplets in a fog stream are much more finely divided)
	2. Created by cellar nozzles

III. Nozzle Types and Characteristics1. Manually adjustable
	1. Discharge rate changed by using a selector ring on a manually adjustable fog nozzle to specific volumes (gpm)
	2. Handline flow rates can be adjusted from 10 – 250 gpm
	3. Master stream line flow rates from 300 – 2500 gpm
	4. The flush setting is used to clean debris away from the nozzle
2. Automatic (constant pressure) nozzles
	1. Allow the nozzle operator to vary the flow while maintaining a working nozzle pressure
	2. Low flows for handlines range from 10 – 125 gpm
	3. Medium flows are from 70 – 200 gpm
	4. Master stream flows are between 250 – 1000 gpm
3. Combination nozzles
	1. Designed to operate at different pressures
	2. Most common pressure is 100 psi
	3. Some combination nozzles operate at pressures ranging from 45 to 75 psi
	4. These nozzles have less nozzle reaction, the droplet size is larger (the density of the fog pattern is less) and the stream has less velocity

IV. Hose Care and Maintenance (Washing and Drying)1. Methods of washing hoses
	1. Hard rubber booster hose, hard intake/suction, and rubber jacketed hose can usually be cleaned with water and a mild soap if necessary
	2. Woven jacket hose can have dirt brushed or swept from it, but it can also be washed and scrubbed with water and a stiff brush if necessary
	3. Hoses exposed to oil should be washed using a stiff brush with pressurized water from a garden hose and a mild soap detergent
	4. Hose washing machines can also be used to clean hoses
		1. Common machines wash hoses up to 3 inches in diameter
		2. Cabinet type machines wash, rinse, and drain fire hoses, and are designed to be used in-station, by one person. They are self-propelled, and can be used with or without detergent
2. Methods of drying hoses (once washed, hoses should be dried before being stored)
	1. Woven jacket hose must be completely dry before being put back on the fire units
		1. The best way to dry the hose after it is cleaned is to hang it in a hose tower or storage rack designed for drying hoses, until it is completely dry. It is best not to dry hoses in direct sunlight
		2. Failure to dry a hose can cause mold and mildew damage to the hose, and is a problem with woven jacket hoses made of cotton or other natural fibers
	2. Hard-rubber booster hose, hard intake/suction hose, and synthetic or rubber jacketed hose can be placed back on fire units wet

V. Nozzle, Hose Tool, and Appliance Use1. Hose tools are different from hose appliances because water does not flow through a hose tool
	1. Hose roller (hose hoist)
		1. Placed over edges or roofs where potential damage is possible
		2. Hose is pulled over the roller to prevent damage.
		3. Used to protect a rope from damage when hoisting tools and equipment
	2. Hose jacket
		1. A two-piece hinged cylinder that is lined with rubber and can temporarily seal a hose rupture or leak
		2. The device is locked over the leak, so the hose can continue being used
		3. Two sizes: 2½-inch and 3-inch
		4. Used to connect a hose with mismatched couplings or damaged couplings
	3. Hose clamp – used to stop water flow in hose-lines
		1. Three types: press down, hydraulic press, and screw down
		2. Used in the following situations:
			1. To keep from charging a hose bed
			2. To allow placement of a burst section of hose
			3. To extend a hose-line
			4. To advance a charged hose-line up stairs
	4. Hose bridge (ramp) – allows traffic to drive over the hose without damaging the hose
	5. Spanners, hydrant wrenches, and rubber mallets
		1. Are all used to help tighten or loosen hose couplings
		2. Hydrant wrenches have a built-in spanner
		3. Are used to remove hydrant caps and open hydrant valves
2. Hose appliances – water flows through hose appliances
	1. Valves – control the flow of water in appliances, hose-lines, fire apparatus, and water systems
		1. Ball valves – are used in fire apparatus discharges and gated wyes. They are open when the handle is in line with the hose and closed when not
		2. Gate valves – are used to control the flow from fire hydrants. The gate moves up and down as the handle and screw assembly is rotated
		3. Butterfly valves – are found on large pump intakes. They have a baffle or plate that turns 90 degrees. When the baffle is in the center of the waterway and aligned with the flow of water, it is fully open. Most are operated by a ¼-turn handle, but some are operated by an electric motor
		4. Clapper valves – are commonly found in Siamese appliances and allow the flow of water in one direction only. The clapper valve incorporates a small disc that is hinged to swing in one direction
3. Valve devices allow firefighters to increase or decrease the amount of hose lines at a fire or an emergency scene
	1. Wye appliances
		1. Have a single female inlet and two male outlets (1 into 2)
		2. Those wyes with valve-controlled outlets are referred to as “gated wyes”
		3. A ball valve is the type of valve commonly used
	2. Siamese appliances
		1. Usually have two female inlets and one male outlet (2 into 1)
		2. If they have three female inlets, they are often referred to as a *triamese* appliance or a *manifold*
	3. Water thief appliances
		1. Like wye appliances
		2. Most often used in wildland firefighting operations
		3. Used in wildland firefighting they usually have a 1½-inch female inlet, a 1½-inch male outlet, and one valve-controlled 1-inch male outlet
	4. Large diameter hose appliances
		1. One kind is the large water thief appliances
		2. Have a large diameter hose (LDH) inlet and outlet, and two or more 2½-inch valve-controlled male outlets
	5. Hydrant valves
		1. Are used when making forward lays from a low-pressure hydrant
		2. Allow the original supply line to be connected to the hydrant and charged before the arrival of an additional pumper
		3. This is when additional lines are connected, and the pressure is boosted without having to interrupt the original supply line flow
	6. Fittings allow firefighters to connect hoses of different sizes and thread types
		1. Adaptors can connect fittings of dissimilar threads with the same diameter (double male or double female)
		2. Reducers are used to connect smaller hose-lines to larger hose-lines
		3. Fittings include
			1. Elbows that provide support for a discharge or an intake hose at the apparatus
			2. Hose caps that protect the threads on the male discharge outlets
			3. Hose plugs that protect the threads on the female inlets found on the Fire Department Connections (FDC)
	7. Intake devices are attached to the suction end of a hard intake to protect the pump from debris. They are commonly referred to as Intake Strainers.
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| **Guided Practice \*** | 1. Divide the students into groups. Have each group demonstrate the proper use of nozzles, hose appliances, and hose tools (including valves and adaptors). The activity should include the deployment of a hose, the connecting of nozzles and other appliances, and the use of hose tools such as hose clamps and bridges. Have each group present a few of the tasks. Use the Presentation Rubric for assessment.
2. Review all the parts of a hose and the local fire department SOPs regarding dried hose storage. Demonstrate the proper method for hand cleaning a hose. Then give each student a section of hose, a stiff bristle brush, a bucket, and a mild soap (if supplies are limited, group the students and have them take turns). Use the Hand Cleaning Hose Checklist for assessment.
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| **Independent Practice/Laboratory Experience/Differentiated Activities \*** |  |
| **Lesson Closure** |  |
| **Summative/End of Lesson Assessment \***  | Fire Stream and Line Selection Quiz and KeyHand Cleaning Hose ChecklistPresentation RubricWriting Rubric |
| **References/Resources/****Teacher Preparation** | ISBN: 0135151112, *Essentials of Firefighting* (5th Edition), International Fire Service Training Association (IFSTA) |
| **Additional Required Components** |
| **English Language Proficiency Standards (ELPS) Strategies** |  |
| **College and Career Readiness Connection[[1]](#footnote-1)** | Social Studies StandardsV. Effective CommunicationA. Clear and coherent oral and written communication1. Use appropriate oral communication techniques depending on the context or nature of the interaction. |
| **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 training evolutions and skill sets that use fire hose as a training tool. |
| **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)