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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** | Water Supply |
| **TEKS Student Expectations** | **130.335. (c) Knowledge and Skills**(8) The student identifies water supply sources and methods to move water from the supply source to the fire. (A) The student is expected to describe the operation of fire hydrants such as fully opened fire hydrants and closed fire hydrants(B) The student is expected to identify the National Fire Protection Association hydrant color code(C) The student is expected to describe making a hydrant-to-pumper connection(D) The student is expected to explain the hazards involved when the hydrant-to-pumper connection is not properly sealed(E) The student is expected to describe the apparatus, equipment, and appliances required to provide water at rural locations |
| **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. The student will be able to describe the operation of fire hydrants, such as fully opened and closed hydrants.
2. Identify the National Fire Protection Association (NFPA) hydrant color code.
3. Describe making a hydrant-to-pumper connection.
4. Explain the hazards involved when the hydrant-to-pumper connection is not properly sealed.
5. Describe the apparatus, equipment, and appliances required to provide water at rural locations by relay pumping or water shuttle.
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| **Rationale** | Understanding water distribution through the deployment of shuttle operations and relays, and through the typical use of hydrants and static sources is important for successful operations in urban and rural areas where firefighters are expected to be efficient in fire control operations. Hydrant operations and the use of associated tools to make connections are important for firefighters to understand. Water flow and pressure in relay and shuttle operations can be disastrous if miscalculated. |
| **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** | * Personal Protective Equipment (PPE)
* Hydrant
* Hard suction hose
* Soft sleeve hose
* Hydrant wrenches
* Spanner wrenches
* Strainer
* Hose rope
* Fire apparatus
* Computers with Internet access
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| **Anticipatory Set**(May include pre-assessment for prior knowledge) | Discuss the following topics with your class:* The different fire flow and pressure requirements for various occupancy types within your city or town limits
* The special hazards within your community, as well as the occupancies with the greatest potential for loss of life

Emphasize how failing to know a basic skill such as opening a valve on a hydrant, or choosing a hydrant with sufficient flow can end with disastrous results. Ask what the firefighter’s responsibility is when it comes to hydrant recognition, setting up relays or shuttle operations, and other fire ground operations. Use the Discussion Rubric for assessment. |
| **Direct Instruction \*** | 1. Fire Hydrants
	1. Dry-barrel hydrants
		1. Installed where hydrants are subject to prolonged freezing temperatures
		2. The main valve is located below the frost line to prevent water from entering the hydrant barrel
		3. The stem nut for the main valve is located at the top of the hydrant
			1. Turning the nut counter-clockwise opens the valve allowing water into the hydrant
			2. Turning the nut clockwise direction closes the valve, raising the drain valve plate which opens the drain holes and causes the barrel to empty
		4. There is a process to verify that the water is draining from the hydrant
			1. Close the main valve until resistance is met, and then give it another ¼-turn
			2. Cap all but one discharge
			3. Place a hand over the open discharge – if the hydrant is draining, a slight vacuum is felt; if not then repeat the previous steps
	2. Wet-barrel hydrants
		1. Sometimes referred to as “frost free” or “California” hydrants
		2. Installed in climates where prolonged freezing is uncommon
		3. Have a compression valve on each outlet that needs to be turned counterclockwise to open it
		4. Do not drain when all the valves are closed; the barrel stays filled with water
2. NFPA Hydrant Color Code
	1. Class AA/Light Blue/1500 gallons per minute (gpm) or greater
	2. Class A/Green/1000–1499 gpm
	3. Class B/Orange/500–999 gpm
	4. Class C/Red/less than 500 gpm
3. Making Hydrant Connections
	1. Associated tools
		1. Combination spanner/hydrant wrench
		2. Four-way hydrant valve (check local Standard Operating Procedures (SOPs))
		3. Items may be kept readily accessible in a tool pouch
		4. The firefighter making the hydrant connection should maintain radio communication with the pump operator as to when to supply water from the hydrant (some departments use an audio or a hand signal in addition, or in place of, radio communication)
	2. Hydrant connection procedure for a forward lay (hose laid from the water source to the fire)
		1. The firefighter
			1. Takes the necessary tools to make the hydrant connection
			2. Removes sufficient hose from the supply bed to “wrap” the hydrant
			3. Wraps the hose around the base of the hydrant, and effectively anchors the hose to it
			4. Signals the driver/operator to proceed to the fire (forward lay)
			5. Makes the proper hose connections to the hydrant
	3. Using a four-way valve
		1. Four-way valves allow
			1. Forward laid supply lines to be charged immediately
			2. Additional pumpers to connect to the hydrant
		2. The second pumper either supplies more lines or boosts the pressure of the original supply line
		3. Typically, the four-way valve is pre-connected to the supply line, to be readily connected to the hydrant
			1. This allows the firefighter “catching” the hydrant to have to complete only the one task of making the valve connection to the hydrant
	4. Reverse lay (hose laid from the fire to the water source)
		1. The method used when firefighters
			1. Take the apparatus to the fire location
			2. Complete a size-up before laying a supply line
			3. Leave the necessary equipment at the scene
			4. Lay the supply line back to the water source
		2. Used primarily when drafting, or when there is a need to boost hydrant pressure for the supply lines
		3. There is often an SOP for setting up relay operations with 2½- or 3-inch supply lines
		4. Some disadvantages
			1. Leaving essential equipment before laying the supply lines can cause delays in the initial attack of a fire
			2. One firefighter is obligated to remain with the pumper at the water source as opposed to being at the fire scene
		5. Does not require the employ of a four-way valve
		6. Can be used when one pumper is alone for an extended period of time and the hose used in the reverse lay becomes the attack line (often used with a wye and a 1½- or 1¾-inch attack assembly)
		7. Reverse lays when using two pumpers
			1. One arrives at the scene and begins extinguishment operations
			2. The second lays a supply line back to the water source
			3. That line is connected to the intake side of the first pumper at the scene
4. Hydrant Connections with a Soft Intake Hose
	1. A firefighter will assist the pump operator in making a soft intake hydrant connection
	2. Some hydrants are not capable of making a large soft intake hose connection because they are not equipped with a steamer connection; therefore, only a smaller dimension supply hose can be used
	3. It is more efficient use of a hydrant if a connection can be made to a large steamer connection with a 4½-inch or larger supply line
	4. Because a hydrant is a pressurized water source, a soft intake hose is appropriate and works effectively
5. Hydrant Connections with a Hard Intake Hose
	1. If a hard intake hose is marked “For Vacuum Use Only,” do not use it for hydrant connections; this type of hard intake hose is meant for drafting operations only
	2. This method may require the coordination of more people to attach than the connection with a soft intake hose would
	3. The positioning of the pumper prior to making the connection is critical (depending on the apparatus, connections may be possible from either the side, front, or rear of the apparatus)
	4. It is good practice to stop the apparatus just short of the hydrant and jockey the apparatus into position to make the connection
	5. Making this type of connection takes practice and precision
6. Meeting Water Needs
	1. Hydrant connections need to be made correctly for the following reasons:
		1. To sustain the fire flow requirements and pressure needs of the systems and the appliances served
		2. To effectively save lives and property from fire damage
		3. To avoid tragedies caused by ineffective pumper-to-hydrant connections
			1. A poor or no water supply for extinguishment endangers the building occupants and the firefighters
			2. A poor or no water supply can result in poor exposure protection and the extension of the fire beyond the building of origin
	2. Firefighters should know the normal and flow pressures of water distribution systems, as well as their flow capacities
		1. High flow/high pressure systems or areas can be an advantage to firefighting operations
		2. Low flow/low pressure systems or areas should be avoided if possible
		3. When pumping from a hydrant, the recommended low residual pressure is 20 psi
		4. Average pressures in water distribution systems in the United States are between 65 and 80 psi, with a typical minimum residual pressure of 20 psi
7. Rural Water Supply Operations
	1. Water shuttles are recommended for distances greater than half a mile, or distances greater than the supply line capability of the department
	2. Tools and/or equipment needed
		1. Attack engine (pumper)
		2. Supply line
		3. Supply engine
		4. Low level strainers
		5. Portable tank(s)
		6. Water tenders
		7. Drafting engine (unless self-filling vacuum tenders are used)
		8. Water source
	3. Relay pumping
		1. In some situations, the water source is close enough to the scene (within supply line capability of the department, and closer than ½ mile) that relay pumping can be used instead of water shuttles
		2. Two factors to consider
			1. Is the water supply capable of maintaining the necessary volume of water for the time required to mitigate the incident?
			2. Can the relay operation be set up quickly enough to be effective?
		3. Tools and/or equipment needed
			1. Water supply
			2. Apparatus with the greatest pumping capacity at the water source
			3. Large diameter supply hose
			4. Attack pumper
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| **Guided Practice \*** | 1. Operating a Dry Barrel Fire Hydrant. Have the students correctly connect to and operate a fire hydrant while wearing PPE. Use the Operating a Dry Barrel Fire Hydrant Checklist for the activity and the assessment.

*Note:* Set up the hydrant, hydrant tools, and supply hose before class.1. Connect and Place a Hard Suction for Drafting. Have the students correctly connect to the fire apparatus in preparation of drafting from a static water source while wearing PPE. Use the Connect and Place a Hard Suction for Drafting Checklist for the activity and the assessment.

*Note:* Set up the hydrant, hydrant tools, and hard suction supply hosebefore class. |
| **Independent Practice/Laboratory Experience/Differentiated Activities \*** |  |
| **Lesson Closure** |  |
| **Summative/End of Lesson Assessment \***  | * Water Supply Quiz
* Operating a Dry Barrel Fire Hydrant Checklist
* Connect and Place a Hard Suction for Drafting Checklist
* Discussion Rubric
* Individual Work Rubric
* Research Rubric
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| **References/Resources/****Teacher Preparation** | * ISBN: 0135151112, *Essentials of Firefighting* (5th Edition)**,** International Fire Service Training Association (IFSTA), 2008
* ISBN: 1428339825, *Firefighter's Handbook: Firefighter I and Firefighter II* (1st Edition), Delmar Cengage Learning, 2008
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| **Additional Required Components** |
| **English Language Proficiency Standards (ELPS) Strategies** |  |
| **College and Career Readiness Connection[[1]](#footnote-1)** | Cross-Disciplinary StandardsI. Key Cognitive SkillsE. Work habits1. Work independently.
2. Work collaboratively.
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| **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 research the history of fire hydrants and write a short paper summarizing their findings. Use the Research Rubric for assessment. |
| **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)