**Chapter 16: Water Supply**

**Chief Concepts**

* In rural areas, fire departments often depend on water from static sources to maintain their water supply. Water may be used from the static source directly or transported via a mobile water supply tanker/tender. These trucks are designed to carry large volumes of water— from 1892 to 18,925 L (500 to 5000 gal.).
	+ Dry or drafting hydrants have a strainer on one end and connect to a fire apparatus to supply water from a static source.
	+ Portable tanks are carried on fire apparatus and can hold between 2271 to 18,925 L (600 and 5000 gal.) of water. These tanks can be set up quickly and linked together to increase the water storage capacity.
	+ A tanker shuttle can deliver water from a static-source fill site to the fire scene.
* Municipal water systems make clean water available to people in populated areas and provide water for fire protection. Hydrants make this water supply available to the fire department.
* Municipal water systems can draw water from wells, rivers, or lakes; they carry the water via pipelines or canals to a water treatment facility and then to the water distribution system, a complex network of underground pipes.
	+ Most municipal water supply systems use both pumps and gravity to deliver water.
	+ Underground water mains come in several sizes. Large mains, or primary feeders, carry large quantities of water to a section of a city. Smaller mains, or secondary feeders, distribute water to a smaller area. The smallest pipes, or distributors, carry water to the users and hydrants along individual streets.
	+ Shut-off valves are located at the connection points where the underground mains meet the distributor pipes. These valves can be used to prevent water flow if the water system in the building or the fire hydrant is damaged.
* The two types of fire hydrants are wet barrel hydrants and dry barrel hydrants.
	+ Wet barrel hydrants are used in areas where temperatures do not drop below freezing. These hydrants do not have to be drained after each use.
	+ Dry barrel hydrants are used in areas where temperatures drop below freezing. When this type of hydrant is not in use, the barrel must be dry.
* Fire hydrants are located according to local standards and nationally recommended practices. In many communities, hydrants are located at every street intersection.
* Fire fighters must be proficient in operating fire hydrants, including the tasks of turning on the hydrant, shutting off the hydrant, and inspecting the hydrant.
* To understand how a water supply system works, you must understand some basic concepts:
	+ The flow or quantity of water moving through a pipe, hose, or nozzle is described in terms of its volume, usually specified in units of litres per minute or gallons per minute.
	+ Water pressure refers to an energy level and is measured in units of kPa (or psi). Volume and pressure are two different, but mathematically related, measurements.
	+ Water that is not moving has potential (static) energy. When water is moving, it has a combination of potential energy and kinetic (in-motion) energy. Both the quantity of water flowing and the pressure under a specific set of conditions must be measured when testing any water system, including hydrants.
	+ Static pressure is created by elevation pressure and/ or pump pressure.
	+ Normal operating pressure refers to the amount of pressure in a water distribution system during a period of normal consumption.
	+ Residual pressure is the amount of pressure that remains in the system when water is flowing.
	+ Flow pressure measures the quantity of water flowing through an opening. A Pitot gauge is used to measure flow pressure in kilopascals or psi and to calculate the flow in litres per minute or gallons per minute.
	+ Knowing the static pressure, the flow in litres per minute or gallons per minute, and the residential pressure enables fire fighters to calculate the amount of water that can be obtained from a hydrant or a group of hydrants on the same water main.
* Fire hoses are used as supply hoses and as attack hoses. Supply hoses are used to deliver water from a static source or from a fire hydrant to an attack engine. Fire hoses range in size from 25 to 152 mm (1 to 6 in.).
	+ Small-diameter hose (SDH) ranges in size from 25 to 51 mm (1 to 2 in.) in diameter. It is commonly used for attack lines.
	+ Medium-diameter (MDH) hose has a diameter of 64 or 76 mm (2.5 or 3 in.). It is used for both attack and supply lines.
	+ Large-diameter hose (LDH) has a diameter of 89 mm (3.5 in.) or more. It is used for supply lines.
* Fire hose is constructed with a waterproof liner surrounded by either one or two outer layers.
* Couplings are used to connect individual lengths of fire hose together. They are also used to connect a hose line to a hydrant, to an intake or discharge valve on an engine, or to a variety of nozzles, fittings, and appliances. A coupling is permanently attached to each end of a section of fire hose.
* The two types of couplings are threaded couplings and Storz-type couplings.
	+ Threaded couplings are used on most hoses up to 76 mm (3 in.) in diameter and on both soft and hard suction hoses. Threaded couplings consist of a male coupling and a female coupling.
	+ Storz-type couplings are the same on both ends.
* Supply hose can either be soft suction or hard suction.
	+ Soft suction hose is a short section of LDH that is used to connect a fire department engine directly to the large steamer outlet on a hydrant. It has a female connection on each end, with one end matching the local hydrant threads and the other end matching the threads on a large-diameter inlet on the engine.
	+ A hard suction hose is a special type of supply hose that is used to draft water from a static source, such as a river, lake, or portable drafting basin. It is designed to remain rigid and will not collapse when a vacuum is created in the hose to draft the water into the pump. It can also be used to carry water from a fire hydrant to the pumper.
* Fire hose should be inspected and tested following the procedures in NFPA 1962.
* The most common types of hose damage are mechanical damage, heat and cold damage, chemical damage, and mildew damage.
* Visual hose inspections should be performed at least quarterly. A visual inspection of hose should be performed after each use. If any defects are found, the length of hose should be marked and removed from service.
* Hose appliances include wyes, gated wyes, water thieves, Siamese connections, adaptors, reducers, hose jackets, hose rollers, and hose clamps.
* Rolled hose is compact and easy to manage. A fire hose can be rolled many different ways, depending on how it will be used. Follow the SOGs/SOPs of your department when rolling hose.
* The objective of laying a supply line is to deliver water from a hydrant or a static water source to an attack engine. In most cases, this operation involves laying a continuous hose line out of the bed of the fire apparatus as the vehicle drives forward. It can be done using either a forward lay or a reverse lay.
	+ A forward lay starts at the hydrant and proceeds toward the fire. The hose is laid in the same direction as the water flows—from the hydrant to the fire.
	+ A reverse lay involves laying the hose from the fire to the hydrant (i.e., opposite to the water flow).
	+ A split hose lay is performed by two engine companies in situations where hose must be laid in two different directions to establish a water supply. The attack engine drops the end of its supply hose at the corner of the street and performs a forward lay toward the fire. The supply engine stops at the same intersection, pulls off enough hose to connect to the end of the dropped supply line, and then performs a reverse hose lay to the hydrant or static water source. Once the two lines are connected, the supply engine can pump water to the attack engine.
* Hose can be loaded in several different ways, depending on how it will be laid out at the fire scene.
	+ The hose must be easily removable from the hose bed, without kinks or twists, and without the possibility of becoming caught or tangled.
	+ The ideal hose load would be easy to load, avoid wear and tear on the hose, have few sharp bends, and allow the hose to play out of the hose bed smoothly and easily.
* Several different techniques are used to carry and advance supply hose.
	+ The best technique for a particular situation will depend on the size of the hose, the distance over which it must be moved, and the number of fire fighters available to perform the task.
	+ The same techniques can be used for both supply lines and attack lines.
* Whenever possible, a hose line should be laid out and positioned as close as possible to the location where it will be operated before it is charged with water.
	+ A charged line is much heavier and more difficult to maneuver than a dry hose line.
	+ A suitable amount of extra hose should be available to allow for maneuvering after the line has been charged.