



FIRE HOSE USAGE FOR NON-FIRE RELATED TASK BEST PRACTICES

An injury recently happened to a Department of Public Works employee using a 1½ inch fire hose connected to a fire hydrant to wash down the salt spreader insert for a dump truck. The hydrant was then partially opened when the worker opened the hose, they injured their upper body due to the sudden nozzle reaction. Let's review some best practices to help prevent injuries when using a fire hose.

The root cause of this incident is the failure to recognize the hazard of water from hoses larger than the typical garden hose. Firefighters spend many hours on the hydraulics and best practices of using hoses 1½ inches and larger because there are hazards that can hurt the user and water supply piping.

Nozzle Reaction with Throttle-Type Nozzle



For every action, there is an equal and opposite reaction. The same force of water used to wash the salt residue also works against the user. The formula for nozzle reaction for smooth bore nozzles is $1.57 \times \text{Diameter}^2 \times \text{pressure at the nozzle}$. For a 1.5-inch nozzle supplied from a hydrant with 60 psi static pressure, the nozzle reaction would be over 200 pounds of impact force when first opening the nozzle's throttle. That's about the same as trying to catch a falling 200-pound object. A 1" tip would reduce the reaction to about 100 pounds.

Water Hammer with Throttle-Type Nozzle

A similar force is transmitted back to the supply piping when the throttle nozzle is suddenly closed. It is called Water Hammer and can damage underground piping, requiring expensive repairs. Firefighters are habituated to open and close all nozzles slowly.

Partially Opening Hydrant

Partially opening a hydrant does not reduce the static pressure in the hose or the nozzle reaction force when the throttle is first opened. It will only reduce the flowing pressure and nozzle reaction force afterward.

Partially opening a hydrant does not close the drain holes at the underground foot of the hydrant. The mechanics of fully opening the hydrant seals the drain holes. Leaving the drain holes open can result in drain holes not working correctly. This would leave water in the hydrant, potentially during winter temperatures, resulting in freeze damage to the hydrant. It could also lead to undermining the soil supporting the footing.

Lessons Learned and Recommendations



- Non-firefighters should use a maximum 1½" hose with a twist nozzle. Twist nozzles reduce the sudden impact nozzle reaction with untrained individuals who open the throttle too fast.
- Opening and closing hydrants is not self-explanatory. Train users to always fully open the hydrant. If needed, a gate or ball valve can be used on the hydrant discharge to restrict the water flow. Always close the hydrant slowly.



- Firefighters are trained in the standing S-shape of the hose to help manage the nozzle reaction. Non-firefighters who will be using 1½" hoses should be taught this strategy. The nozzle should be shut off when moving the hose.