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Tanker Fill Tests

Evaluating 2-1/2" Direct Fill Lines

Colton, New York

August 24, 2008



Overview

- On August 23rd and 24th, 2008, the Colton (NY) Fire District hosted a Rural Water Supply Operations Seminar and Drill presented by GBW Associates, LLC.
- During the drill, it became obvious that all of the tankers were hampered in their fill times when using their 2-1/2-inch direct fill lines.
- After the water shuttle drill on second day of the seminar, several tankers were tested using various fill methods in an effort to show which methods worked best in terms of reducing fill times.
- The results of those tests are documented in this presentation.

The Tankers

- Colton Tanker 4
 - 1978 Saulsbury tanker body/ 2003 International Chassis
 - 1,800 gallon tank
 - Hale 350 gpm PTO pump
 - 10-inch square dump (with rear, side adaptor chute)
 - One, 2-1/2-inch direct fill line w/quarter-turn ball valve.



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The Tankers

- Pierrepont Tanker 35
 - 1989 Four Guys
 - 1,800 gallon tank
 - Hale 500 gpm pump
 - 8-inch round dump w/cam lock flexible tube
 - Two, 2-1/2-inch direct fill lines w/quarter-turn ball valves.



The Tankers

- Hopkinton Engine Tanker 44
 - 1981 E-One
 - 2,200 gallon tank
 - Hale 1,500 gpm pump
 - 5-inch round dump equipped with a Jet Dump
 - No direct fill – must be filled back through the dump or through the pump.





The Problem

- All four of the tankers had small, 2-1/2-inch direct fill lines – three of them had a 2-1/2-inch, ¼-turn ball valve as their control mechanism.
- The small, direct fill lines seemed to result in personnel wanting to connect 2-1/2-inch hose to the inlets.
- The use of 2-1/2-inch hose to fill the tankers resulted in very slow fill times when compared with how fast the tankers could dump.

2-1/2-inch Direct Fills



When used with 2-1/2-inch hose, these direct fills severely hampered fill times during the drill.



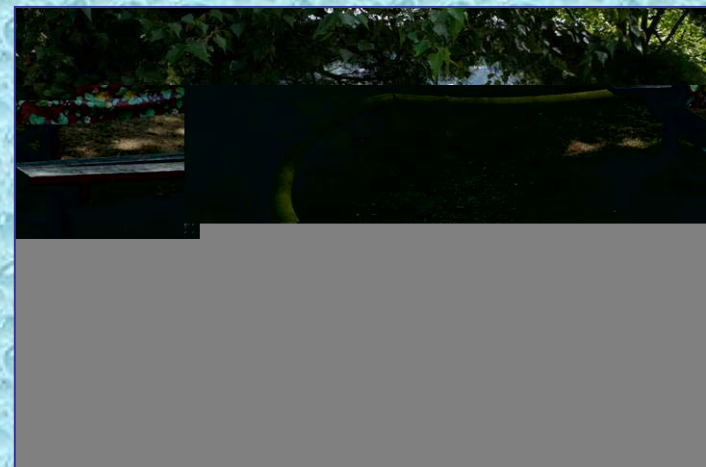


The Hypothesis

- Using 4-inch hose connected directly to a tanker's 2-1/2-inch direct fill inlet will improve the tanker's fill rate.
- Using an “over-the-top” fill pipe will improve a tanker's fill rate in comparison to using a 2-1/2-inch direct fill inlet.

The Test Set-up

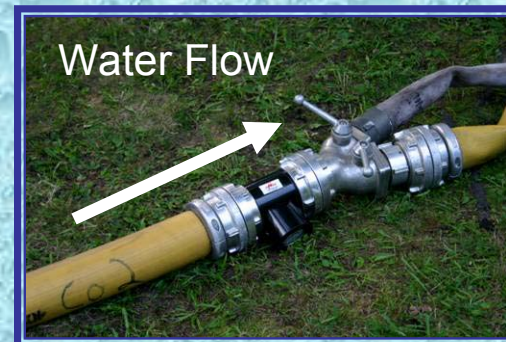
- Colton FD's fire boat was used to pump the water needed for the tests.
- The boat was set-up to draft along the shore of the Raquette River and it pumped to a 4" x 2-1/2" x 2-1/2" gated wye, uphill through 300 ft of 4" LDH.



The Test Set-up



- The gated wye had a pressure gauge placed in-line between the wye and the 4-inch supply hose.
- The gauge was used to measure inlet pressure at the wye.
- A 100-ft length of 2-1/2-inch or 4-inch was then used to connect to the direct fill inlets on the tankers.



Establishing Constants

- In order to collect comparable data, a few constants had to be established.
 - When pumping to the gated wye, the fireboat would always maintain a reading of 50 psi on the in-line gauge with water flowing.
 - When connecting the 4-inch hose to the direct fills, a 4"x2-1/2" adaptor would always be used.
 - The hose lines used for filling would always be 100-ft in length from the wye to the direct fill inlet.
 - All tankers were completely empty before being filled.



Test Results: Tanker 4

- Single, 2-1/2" fill hose connected to the 2-1/2" direct fill
 - 6 minutes, 42 seconds
 - 268 gpm
- Single, 4" fill hose connected to the 2-1/2" direct fill
 - 2 minutes, 53 seconds
 - 625 gpm
 - **A 133% improvement over a single, 2-1/2" hose!**



Test Results: Tanker 4 w/Fill Pipe

- Because Tanker 4 has a ladder rack over top of its hose bed, a decision was made to fashion a 4", over-the-top fill pipe that would allow a direct flow of water into the tank's fill tower.
- The fill pipe was made using Schedule 40 PVC pipe and it was outfitted with a 4" Storz swivel connection.
- The pipe was anchored to the ladder rack so that no one would have to hold the device during the fill process.





Test Results: Tanker 4 w/Fill Pipe

- Single, 4" fill hose connected to the 4" over the top fill pipe
 - 2 minutes, 15 seconds
 - 800 gpm
 - **A 199% improvement over a single, 2-1/2" hose line!**



Test Results: Tanker 88

- Single, 2-1/2" fill hose connected to the 2-1/2" direct fill
 - 5 minutes, 32 seconds
 - 325 gpm
- Single, 4" fill hose connected to the 2-1/2" direct fill
 - 3 minutes, 12 seconds
 - 563 gpm
 - **A 73% improvement over a single, 2-1/2" hose!**



Test Results: Tanker 88 w/Fill Pipe

- The Colton FD had a “homemade,” over-the-top fill pipe that was designed to be hand-held.
- The device was made using 3-inch aluminum pipe and was outfitted with a 2-1/2” NST female swivel connection.
- The fill pipe would normally be supplied by a 2-1/2” supply hose and someone would hold the pipe in position on top of the tanker.





Test Results: Tanker 88 w/Fill Pipe

- Single, 2-1/2" hose to the fill pipe
 - 4 minutes, 13 seconds
 - 427 gpm
 - A 31% improvement over a single, 2-1/2" hose to the 2-1/2" direct fill inlet.
 - **A 24% reduction in flow compared to a single, 4" to the 2-1/2-inch direct fill inlet.**



Test Results: Tanker 35

- Single, 2-1/2" fill hose connected to the 2-1/2" direct fill
 - 4 minutes, 56 seconds
 - 365 gpm
- Single, 4" fill hose connected to the 2-1/2" direct fill
 - 3 minutes, 30 seconds
 - 514 gpm
 - **A 41% improvement over a single, 2-1/2" hose!**



Test Results: Engine Tanker 44

- Single, 2-1/2" fill hose connected to the 2-1/2" direct fill
 - 4 minutes, 53 seconds
 - 461 gpm
- Single, 4" fill hose connected to the 2-1/2" direct fill
 - 3 minutes, 19 seconds
 - 677 gpm
 - **A 47% improvement over a single, 2-1/2" hose!**



Summary

TA-88



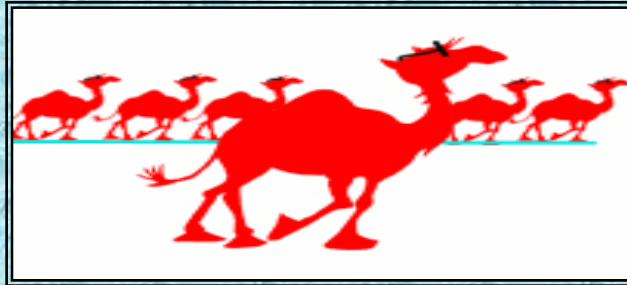
- It was demonstrated with all four tankers that 4" hose is clearly a better choice to use for filling tankers when given the choice between using 2-1/2" or 4" hose.
- Even when the direct fill piping is 2-1/2", 4-inch hose is still a better choice.
- While it may appear that only a couple minutes were shaved off of each fill time, in a tanker shuttle operation, these shaved minutes mean more trips can be made – thus more water hauled and thus a higher, total delivery rate.

Summary

TA-88



- In terms of the over-the-top fill pipes, they both out performed the single, 2-1/2" hose connected to the 2-1/2" direct fill inlet. Something to consider if a retrofit of a direct inlet is not feasible.
- Again, the large conduit excelled. The 4-inch over-the-top fill pipe filled at an incredible 800 gpm. Quite an achievement for a homemade system.



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For more information contact us at

thebigcamel@gotbigwater.com