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Tanker Fill Tests

Evaluating Direct Fill Lines
DeKalb County, Alabama
November 16, 2008

Overview



- On November 15th and 16th, 2008, the DeKalb County (AL) Association of Fire Departments hosted a Rural Water Supply Operations Seminar and Drill presented by GBW Associates, LLC of Westminster, Maryland.
- 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 was over, five tankers were tested using various fill methods in an effort to show which methods worked best in reducing fill times.
- The results of those tests are documented in this presentation.



- Adamsburg Tanker 1
 - 2007 Southern Fire tanker
 - 2,500 gallon tank
 - Waterous 1,250 gpm pump
 - Three, 10-inch square dumps (rear and two sides)
 - Two, 3-inch direct fill lines on rear of tank. Each equipped with a ¼-turn ball valve as the control mechanism.





- Aroney Engine 3
 - 2007 Blue Grass tanker
 - 3,000 gallon elliptical tank
 - Darley 1,250 gpm pump
 - 10-inch square dump (rear)
 - One, 2-1/2-inch direct fill line with a ¼-turn ball control valve and one, 4-inch direct fill line with a gate vane. Both fills are on the rear of the tank.





- Dogtown Tanker 1
 - Converted fuel truck
 - 1,400 gallon tank
 - 250 gpm pump
 - 10-inch square dump (rear)
 - One, 2-1/2-inch, over-the-top, direct fill line on the rear of the tank. The fill line is equipped with a ¼-turn ball valve as the control mechanism.





- Fyffe Engine 4
 - 2008 KME
 - 1,800 gallon tank
 - Hale 1,250 gpm pump
 - 10-inch square dump (rear)
 - Two, 2-1/2-inch direct fills on the rear of the tank – each are outfitted with ¼-turn ball valves as its control mechanism.





- Hammondville Truck 1
 - 1998 KME
 - 1,500 gallon tank
 - Hale 250 gpm pump
 - 10-inch square dump (rear)
 - Two, 3-inch direct fills on the rear of tank – each equipped with a ¼-turn ball valve as its control mechanism.





- All five of the tankers had small, 2-1/2-inch direct fill lines with a 2-1/2-inch, 1/4-turn ball valve as their control mechanism.
- Fortunately, one of the tankers (Aroney E3) had a 4-inch direct fill line in addition to a 2-1/2-inch direct fill.
- The small, direct fill lines seemed to result in personnel wanting to connect 2-1/2-inch hose to the inlets.
- During the course of the water supply drill, 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

Hammondville Truck 1



Fyffe Engine 4



Aroney Engine 3



Dogtown Tanker 1



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

Adamsburg Tanker 1





- Using 4-inch hose instead of 2-1/2-inch hose to fill a tanker will improve the rate at which that tanker can be filled – even when using a 2-1/2-inch direct fill line.



- Fyffe Engine 2 (2,000 gpm) was used to pump the water needed for the tests.
- The engine was connected to a fire hydrant and a 5-inch supply line was taken into the pump from the hydrant's steamer outlet.
- Because the hydrant was limited in its operating pressure, a 3-inch line was run from one of the hydrant's 2-1/2-inch outlet to an intake on the pump. This improved the overall available water.



The Test Set-up

- Fyffe Engine 2 discharged water to a 100-ft section of 5-inch hose finished off with a 5" x 2-1/2 x 2-1/2" gated wye.
- Three tests were run with each tanker using a 50-ft length of 2-1/2-inch, a 50-ft length of 3-inch, or a 100-ft length of 4-inch hose to fill through the direct fills.



Establishing Constants

- In order to collect comparable data, a few constants had to be established.
 - When pumping to the gated wye, Fyffe E2 would always maintain a discharge pressure reading of 75 psi with water flowing.
 - When connecting the 4-inch hose to the 2-1/2" direct fills, a 4"x2-1/2" adaptor would always be used.
 - The hose lines used for filling would always be 50-ft in length from the wye to the direct fill inlet except when using 4-inch hose – those would always be 100-ft in length.
 - All tankers were completely empty before being filled each time.



Test Results: Adamsburg Tanker 1

- Dual, 2-1/2" fill hoses connected to the 2-1/2" direct fills
 - 3 minutes, 2 seconds
 - 824 gpm
- Dual, 3" fill hoses connected to the 2-1/2" direct fills
 - 2 minutes, 32 seconds
 - 987 gpm
- Single, 4" fill hose connected to the 2-1/2" direct fill
 - 2 minutes, 29 seconds
 - 1007 gpm
 - **A 22% improvement over dual, 2-1/2" hoses!**



Test Results: Aroney Engine 3

- Single, 2-1/2" fill hose connected to the 2-1/2" direct fill
 - 3 minutes, 41 seconds
 - 814 gpm
- Single, 3" fill hose connected to the 2-1/2" direct fill
 - 3 minutes, 31 seconds
 - 853 gpm
- Single, 4" fill hose connected to the 2-1/2" direct fill
 - 2 minutes, 57 seconds
 - 1017 gpm
 - **A 25% improvement over a single, 2-1/2" hose!**



2-1/2-inch hose

3-inch hose



4-inch hose



Test Results: Dogtown Tanker 1

- Single, 2-1/2" fill hose connected to the 2-1/2" direct fill
 - 2 minutes, 51 seconds
 - 491 gpm
- Single, 3" fill hose connected to the 2-1/2" direct fill
 - 1 minutes, 55 seconds
 - 730 gpm
- Single, 4" fill hose connected to the 2-1/2" direct fill
 - 1 minutes, 20 seconds
 - 1050 gpm
 - **A 113% improvement over a single, 2-1/2" hose!**



Test Results: Fyffe Engine 4

- Dual, 2-1/2" fill hoses connected to the 2-1/2" direct fills
 - 1 minutes, 49 seconds
 - 991 gpm
- Dual, 3" fill hoses connected to the 2-1/2" direct fills
 - 1 minutes, 31 seconds
 - 1187 gpm
- Single, 4" fill hose connected to the 2-1/2" direct fill
 - 1 minutes, 25 seconds
 - 1271 gpm
 - **A 28% improvement over dual, 2-1/2" hoses!**



2-1/2-inch hose

3-inch hose



4-inch hose



Test Results: Hammondville Truck 1

- Dual, 2-1/2" fill hoses connected to the 2-1/2" direct fills
 - 1 minutes, 30 seconds
 - 1000 gpm
- Dual, 3" fill hoses connected to the 2-1/2" direct fills
 - 1 minutes, 27 seconds
 - 1034 gpm
- Single, 4" fill hose connected to the 2-1/2" direct fill
 - 1 minutes, 11 seconds
 - 1268 gpm
 - **A 27% improvement over dual, 2-1/2" hoses!**



2-1/2-inch hose

3-inch hose



4-inch hose



Summary

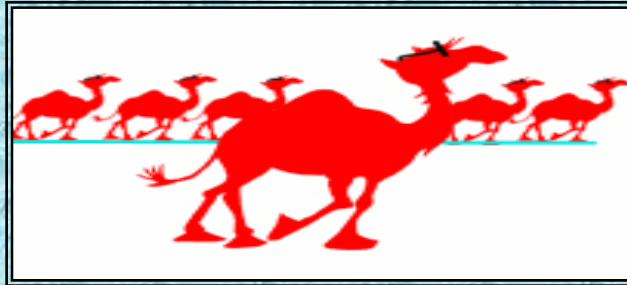


- It was demonstrated with all five tankers that 4" hose is clearly a better choice to use for filling tankers when given the choice between using 2-1/2", 3", or 4" hose. ***Even when the direct fill piping is 2-1/2", 4-inch hose is still a better choice.***



Summary

- While it may appear that only a minute or so was shaved off of each fill time during these tests, in a tanker shuttle operation, this shaved time means more trips can be made – thus more water hauled and thus a higher, total delivery rate.



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