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Front Suction Flow Test

Evaluating Front Suction
Flow Capacity
Seneca County, New York
April 5, 2009

Overview

- On April 4th and 5th, 2009, the Seneca County, New York, Office of Emergency Services held a Rural Water Supply Operations Seminar and Drill presented by GBW Associates, LLC of Westminster, Maryland.
- During the seminar, a discussion occurred involving drafting operations using the front suction intake on midship mounted fire pumps.
- The Fayette FD had recently acquired a 1,500 gpm pumper and they were interested in knowing how much water they could flow when drafting solely from the front suction intake.
- After the water shuttle drill on the second day of the seminar was over, the Fayette pumper was tested while drafting from the front suction intake; the results of that test are documented in this presentation.

The Pumper

- Fayette Engine 403
  - 1993 Pierce Lance chassis
  - Waterous 1,500 gpm single-stage pump
  - Cummins 350 hp motor
  - Three, 6-inch suction intake connections – one on each side and one on the front.
  - Carries 6-inch suction hose and the front suction is outfitted with a pre-connected section.

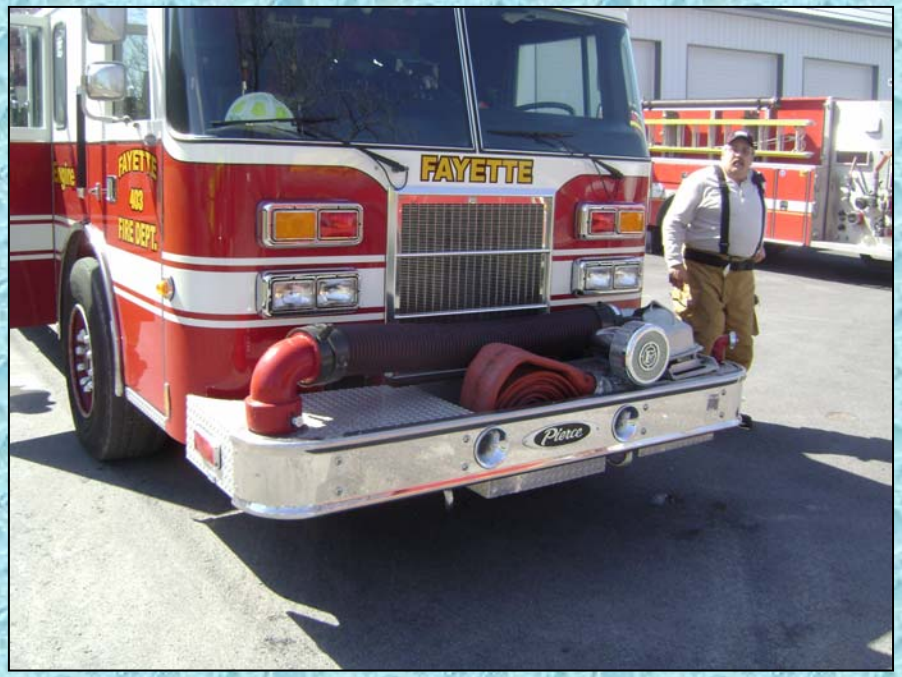
The Problem

- In general, front suction intakes on pumpers with mid-ship mounted fire pumps are not rated for drafting at 100% pump capacity.
- Because these front suctions have to be plumbed up and over the front axle and perhaps around other obstacles before reaching the pump's intake manifold, front suctions usually produce a lower flow rate from draft than when a standard side (steamer) suction is used.

The Problem

- The real question is, “When drafting, how much reduction in flow occurs when using the front suction intake as the sole suction source?”
- Various sources and performance tests have indicated that front suctions can produce flows as low as 60% of the pump’s rated capacity when the front suction is the only suction intake used for drafting.

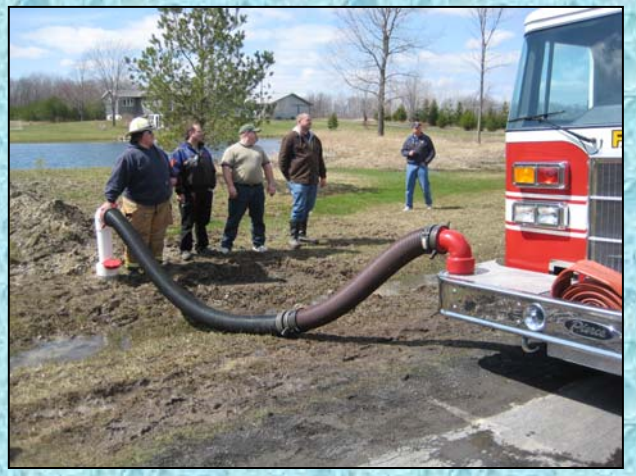
The Hypothesis

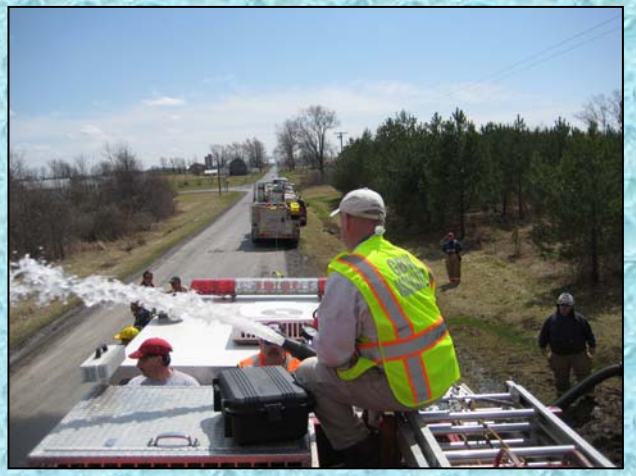


- When drafting using only its front suction, Fayette E403 will be restricted in its flow capability by as much as one-third.

The Test Set-up

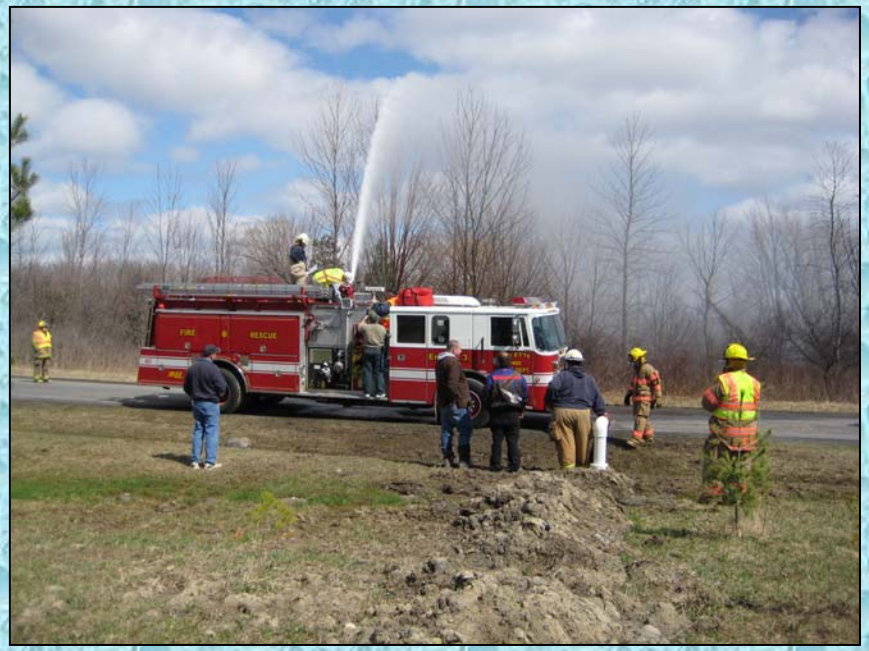
- Engine 403 (1,500 gpm) was connected to a 6-inch dry fire hydrant using 16-feet of 6-inch suction hose.
- The dry fire hydrant had been used previously in the day for filling tankers in the 2-hour water shuttle exercise – so the hydrant was confirmed operational and unobstructed.
- The lift for the test was less than 10-feet, thus eliminating any issues with the pump being limited in its rated capacity due to lift height.





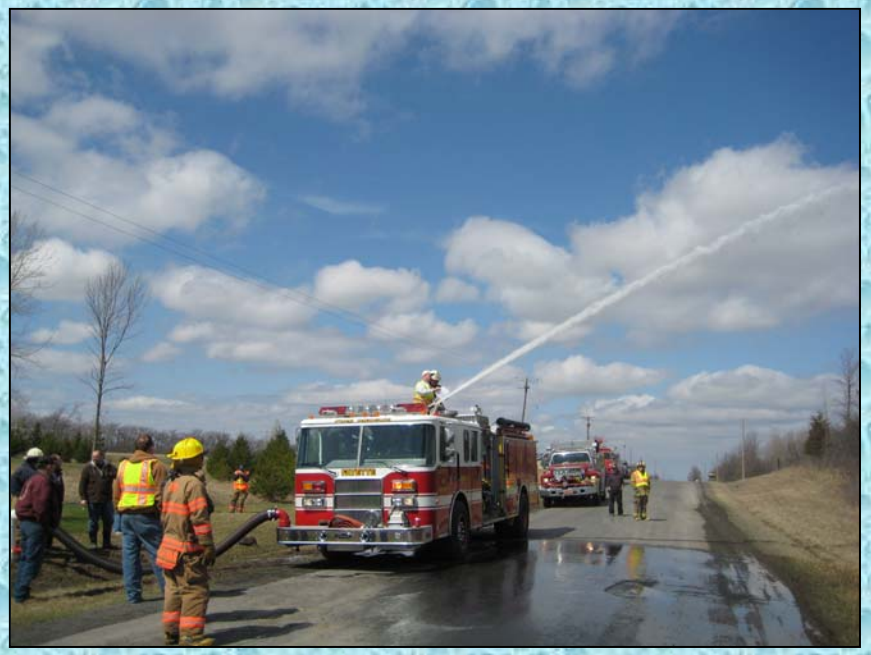
The Test Set-up

- For the first flow test, a 1-7/8-inch fixed-pitot tip was placed on the pumper's pre-piped deck gun and flow was measured using that device.
- For the second flow test, the 1-7/8-inch tip was removed and replaced with a 2-1/4-inch tip and flow was measured using that tip.



Establishing Constants

- In order to collect comparable data, a few constants had to be established.
  - The same suction hose set-up was used for each flow test.
  - The transmission remained in the same gear for each flow test.
  - No other devices were used to flow water while the deck gun was flowing.
  - Each test was stopped when there was “no more throttle” available.



Test Results: 1-7/8-inch Tip

Tachometer	Master Discharge Gauge Reading	Nozzle Pitot Reading	Flow
1000 rpm	65 psi	50 psi	740 gpm
1210 rpm	100 psi	78 psi	924 gpm
1300 rpm	115 psi	94 psi	**1012 gpm**

Test Results: 2-1/4-inch Tip

Tachometer	Master Discharge Gauge Reading	Nozzle Pitot Reading	Flow
1250 rpm	65 psi	36 psi	**905 gpm**

Summary

- It was demonstrated that Fayette Engine 403 was unable to flow its rated capacity from draft when using its front intake as the only suction intake.
- The size of the nozzle tip was increased in order to see if the pump could flow more water with less nozzle pressure – it could not.

Summary

- The data collected from the two flow tests show that this 1,500 gpm could only flow about 1,000 gpm – or about 66% of its rated capacity – and this was at a lift less than 10-feet.
- An important note about this test is that the pump that was tested was a large pump and 66% of its capacity still produced 1,000 gpm. However, if a higher flow would have been needed or the lift would have been higher, this pumper could not have supported that type of flow.

Summary

- Unfortunately, the plan was to compare the flow of Engine 403's front suction with the flow of its side suction intakes, but the primer pump solenoid broke and the test was stopped before flow data could be recorded.

Summary

- Finally, the results of this test reinforce two points:
  - When using a front suction for drafting, expect flows significantly less than rated pump capacity. This is important if you are expected to increase flow at some point in the operation and you are only drafting using your front suction intake.
  - The use of “keystone” valves or Master Intake Valves (MIV) on side suction intakes allow for the easy addition of a side suction line even with the front suction already in use.

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