2-1/2” Discharge Flow Test

Evaluating the Flow Capacity of 5” LDH Used on a 2-1/2” Discharge

Seneca County, New York
April 5, 2009
Overview

- On April 4\textsuperscript{th} and 5\textsuperscript{th}, 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 tanker shuttle drill on Sunday the 5th, some discussion arose involving the flow capacity of 2-1/2-inch discharges on centrifugal fire pumps.
- The specific inquiry involved the use of 5-inch hose on a 2-1/2-inch discharge and the amount of water that could be move through that hose.
- Ovid FD Engine 1104 (1,250 gpm) was used to conduct a flow test involving the capability of a 2-1/2-inch discharge when using 5-inch hose.
The Pumper

• Ovid Engine 1104
  – 1984 Saulsberry/Ford chassis
  – Hale 1,250 gpm single-stage pump
  – One, 6-inch suction intake connection.
  – Carries 6-inch suction hose.
The Problem

• Traditional 2-1/2-inch discharges are generally limited in their flow to only a percentage of the fire pump’s rated capacity.
• Just because a 2-1/2” x 5” adaptor can allow 5-inch LDH to be connected to a pump’s 2-1/2” discharge, this does not mean that a high flow rate will be obtained – as would be expected with LDH.
The Hypothesis

- A single, 2-1/2-inch discharge cannot flow the rated capacity of the pump even when pumping into a 5-inch LDH line.
The Test Set-up

- Engine 1104 (1,250 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.
- Lift was less than 10-feet thus allowing the pump to develop full capacity if possible.
- Two flow tests were run using two different hose set-ups.
The Test Set-up: Flow Test #1

- A portable master stream device outfitted with a 2-inch tip was supplied by a 100-ft section of 5-inch LDH which was connected to one of Engine 1104’s 2-1/2-inch discharges.
- Flow was measured using a pitot tube at the 2-inch tip.
The Test Set-up: Flow Test #2

- A portable master stream device outfitted with a 2-inch tip was supplied by a 100-ft section of 5-inch LDH which was then supplied by two, short sections of 3-inch hose using a clappered siamese.
- The two, 3-inch lines were connected to two of Engine 1104’s 2-1/2-inch discharges.
- Flow was measured using a pitot tube at the 2-inch tip.
Establishing Constants

- In order to collect comparable data, a few constants had to be established.
  - The same suction hose set-up was used each time.
  - The vehicle’s transmission remained in the same gear each time.
  - No other devices were used to flow water while the portable monitor was flowing.
  - Each test was stopped when there was “no more throttle” available.
## Test Results: Flow Test #1

<table>
<thead>
<tr>
<th>Master Discharge Gauge Reading</th>
<th>Nozzle Pitot Reading</th>
<th>Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>80 psi</td>
<td>40 psi</td>
<td>751 gpm</td>
</tr>
<tr>
<td>100 psi</td>
<td>50 psi</td>
<td>840 gpm</td>
</tr>
<tr>
<td>105 psi</td>
<td>54 psi</td>
<td>873 gpm</td>
</tr>
<tr>
<td>125 psi</td>
<td>64 psi</td>
<td><strong>950 gpm</strong></td>
</tr>
</tbody>
</table>

Single, 5-inch LDH hose, 100-ft in length supplied by a single, 2-1/2-inch discharge.
## Test Results: Flow Test #2

<table>
<thead>
<tr>
<th>Master Discharge Gauge Reading</th>
<th>Nozzle Pitot Reading</th>
<th>Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>80 psi</td>
<td>50 psi</td>
<td>840 gpm</td>
</tr>
<tr>
<td>100 psi</td>
<td>62 psi</td>
<td>935 gpm</td>
</tr>
<tr>
<td>105 psi</td>
<td>66 psi</td>
<td>965 gpm</td>
</tr>
<tr>
<td>125 psi</td>
<td>74 psi</td>
<td>1022 gpm</td>
</tr>
</tbody>
</table>

Single, 5-inch LDH hose, 100-ft in length supplied by two, 2-1/2-inch discharges.
Summary

• It was demonstrated that a single, 2-1/2-inch discharge could not supply 1000 gpm to a 5-inch LDH.
• However, when two, 2-1/2-inch discharges were used, the 1,000 gpm goal was reached.
• The results of this simple demonstration are important to remember because it is easy to connect a 5-inch line to any discharge – however, we have to remember that unless that discharge is designed for high flows – that discharge most likely will be limited in its flow capacity.
• Kind of like putting a 2-1/2” fog nozzle on a ¾” booster line – you are still limited in flow.