WATER TRANSFER
FLOW DEVICES

PERFORMANCE TESTING

CONDUCTED BY THE
BELMONT COUNTY TANKER TASK FORCE
MARCH 20, 2016
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Scope of Testing:

On March 20, 2016 the Belmont County Tanker Task Force conducted testing on various jet siphons and low level strainers with jet siphons to determine the flow from each appliance. The test was done at (2) two different pressures to determine if there was distinct difference of flow between the pressure settings. The testing performed is comparable to the test conducted by \textit{GOT BIG WATER} (GBW Associates, LLC) 2012. All test were conducted as accurately as possible to achieve the truest results.

Test Site:

The testing was done in Dillies Bottom at the Ohio West Virginia Excavating Scale House. The scale was a certified full size truck scale with a digital read out display. The scale was calibrated one week prior to our testing.

Jim Delman and Allan Ketzell III conducted the testing with the assistance of several WSO from the BCTTF.

Draft Engine Used:

The Engine used as the draft engine was Martins Ferry Engine 28-3. E28-3 is a 2013 Sutphen, 1750gpm, 450 hp Cummins Engine.

Suction Hosed used for Water Transfer:

The suction hose for both drafting and water transfer was the Kocheck 6” hard tube, 6” in diameter and 10ft long.
Jet Siphons Testing

Two jet siphons were used during this test, Kocheck Jet Siphon with a ¾” orifice, Action Jet Siphon with a 1” orifice, the action jet siphon also has an adjustable orifice that can be moved in and out. The testing was done with two different Pump Discharge Pressures, 125psi and 150 psi. Six different test were conducted on the jet siphons. All test was conducted with 50ft of 1-3/4 hose. 6” Kocheck hard suction hose was used to transfer the water from the device.

KOCHECK JET SIPHON

Test 1:
Kocheck Jet Siphon ¾” orifice @ 125psi PDP
Test 2:
Kocheck Jet Siphon ¾” orifice @ 150psi PDP

A 10ft section of Kocheck 6” hard suction hose was used.
ACTION (POWER JET SIPHON, ADJUSTABLE ORIFICE TUBE)

Test 3:
Action Jet Siphon, 1” orifice, Orifice pipe in, 125psi PDP

Test 4:
Action Jet Siphon, 1” orifice, Orifice pipe out, 125psi PDP

Test 5:
Action Jet Siphon, 1” orifice, Orifice pipe in, 150psi PDP

Test 6:
Action Jet Siphon, 1” orifice, Orifice pipe out, 150psi PDP
Low Level Strainers with Jet Siphons Testing

Four low level strainers with jet siphons were used for the test doing six test. Two brands were tested twice due to different orifice sizes. 150 psi test pressure was used for all six test. All test were conducted with Kocheck 6” hard tube, 10’ long and 1-3/4 hose, 50’long feeding the appliance.

Test 7:
Kocheck Low Level Strainer, Jet Siphon Orifice ¾”, 150psi PDP
Test 8:
Fol Da Tank Low Level Strainer, Jet Siphon Orifice 1” 150 psi PDP The standard Fol Da Tank Strainer has a 3/4” jet siphon. (This strainer was bored out to 1” by the Sunset Heights Fire Department)

Test 9:
Fol Da Tank Low Level Strainer, Jet Siphon Orifice 3/4” 150 psi PDP

Figure 10: Fol Da Tank Low Level Strainer with Jet Siphon 1”

Figure 11: Fol Da Tank Low Level Strainer with Jet Siphon 1”
Test 10:
Task Force Tips TFT Low Level Strainer, Jet Siphon Orifice 1” 150 psi PDP
Figure 14: TTF Low Level Strainer, 1-1/2 jet intake swivels 2 different ways, 6” intake moves up and down

Figure 15: TTF Low Level Strainer with 1” jet siphon
Test 11:
Firovac Low Level Strainer, Jet Siphon Orifice 1/2” 150 psi PDP. The Firovac orifice is
designed to be change the orifice tip to increase or decrease the flow.

Test 12:
Firovac Low Level Strainer, Jet Siphon Orifice 5/8” 150 psi PDP.

Figure 16: Firovac Low Level Strainer jet siphon with interchangeable orifices
Figure 17: Firovac Low Level Strainer jet siphon orifice

Figure 18: Firovac Low Level Strainer with open bottom
Figure 19: Firovac Low Level Strainer with jet siphon 1” tube, interchangeable orifice tip
Test Lay Out

The test lay out involved using three dump tanks. The first tank was a single lane 2000 gallon tank that was placed on the truck scale to collect and weigh the transfer water. The second tank was a single lane 2000 gallon tank where the test appliances were placed to transfer the water to the scale tank. The third tank (Supply Tank) was a 2000 gallon conventional size tank that supplied the draft engine. When the test was complete the scale tank was dumped into a drain alongside the scale. The tank was reweighed after each test.

Figure 20: Test Lay out showing the main draft tank (orange tank)
Testing Procedures

Martins Ferry Engine 28-3 was the draft engine, E28-3 obtained a draft from the orange 2000 gallon conventional size tank. Engine 28-3 drafted trough a 6” 10’ Kocheck hard suction hose with a Firovac low level strainer. Also a 1-3/4 line was used to flow back into the Supply tank to have a constant flow and not loose prime between tests.

Engine 28-3 used a gated wye on a LDH discharge with an inline pressure gauge, which controlled the 1-3/4 line connected to the transfer test appliance. The Engine pressure was set to the desired test pressure.

An individual was positioned at the gated wye with a stop watch. His job was to open the valve start the time for 1 min, record the reading of the pressure gauge, and then close the valve at the 1 minute mark.

To begin the test the weight of the scale tank was recorded. The transfer line was opened and flowed and then closed at the 1 minute mark. When the transfer water stopped flowing, the transfer tube was removed from the scale tank and the weight of the scale tank and the water was recorded. After the weight was recorded the scale tank was drained and the appliances were changed and prepared for the next test. Tenders were also positioned to supply both tanks during the test procedures.
The weights were recorded on an excel spread sheet and the gallons per minute (GPM) flow rate was calculated as follows:

\[
\frac{\text{Ending Weight} - \text{Starting Weight}}{8.35 \text{lbs}} / \text{minutes of flow}
\]

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**Test Results**

The final test results show that on the jet siphons the higher pressures achieved a higher flow but also produced a high orifice flow rate. This is the important thing that we need to be aware of due to the fact that this higher orifice flow rate takes away the overall GPM that can be delivered to the fire ground. The most efficient with a Transfer (Net Flow) Rate closest to the desired flow of 1000gpm would be the Fireovac with a Net Flow of 972gpm and an Orifice flow rate of 142gpm.
<table>
<thead>
<tr>
<th>DEVICE</th>
<th>ORFICE SIZE</th>
<th>PUMP DISCHARGE PRESSURE</th>
<th>PSI AT APPLIANCE</th>
<th>FLOW RATE OF ORIFICE</th>
<th>PEAK TRANSFER RATE (GPM)</th>
<th>TRANSFER LESS ORRICE FLOW (NET FLOW)</th>
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<tbody>
<tr>
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**Summary**

The results were very interesting in terms of the difference between the net flow and the peak transfer flow. Firefighters never think about how much water it takes to move this water from one tank to the other. This somewhat small amount will make a big difference in what can be delivered to the fire ground. In comparison of the jet siphons vs the low level strainer it appears that the low levels are much more efficient in transferring water due to the orifice flow and the overall net flow.
The Belmont County Tanker Task Force Coordinators would like to thank all personnel who attended the testing session. There were 35 firefighters in attendance representing 15 departments.

Departments in attendance:

Belmont County: Sunset Heights Brookside Wolfhurst OR & W Smith Township Bethesda Powhatan Martins Ferry Morristown Colerain Neffs

Columbiana County: Highland Town Jefferson County: Brilliant Marshall County WV. Moundsville Vol. Wayne County Apple Creek VFD

Report by: Jim Delman, BCTTF Coordinator, Fire Chief Sunset Heights Fire Dept.
Allan Ketzell III, BCTTF Coordinator, Fire Chief Brookside Fire Dept.
Belmont County Tanker Task Force
Portable Pump Test

Belmont County Tanker Task Force has a Portable Pump trailer that responds on all Tanker Task Force activations. Wolfhurst Fire Department houses a 16 ft enclosed trailer that carries (4) 3 inch trash pumps, 3 inch hard suction draft hoses, 3 inch supply line, 5 inch supply line and a numerous amount of fittings and adaptors.

It was decided that a trash pump vs a pressure pump would work the best due to the weight of the pump. A lighter trash pump, will allow one person to carry and set it up for water flow operations.

This test was conducted to see which flow set up would give the best transfer rate of water from the pumps to the Folda Tank. A concern that the WSO’s had is using the 4 way Siamese valve. It seemed that since the pumps were not pressure and only volume, when pumping into the 4 way Siamese valve it created a flow restriction from 4 lines at one time.

All test were performed for one minute to determine the GPM of flow from each particular set up.
Test 1:
The four pumps were all set up to draft out of the folda tank with each pump having a 14 foot section of 3” suction hose with a Fireovac low level/floating strainer.
Each pump had a 3” discharge hose (25ft) connected to a 4 way Siamese which supplied a 5” (50ft) hose that was connected to a 5” elbow that emptied into the scale tank.

Test 1 Results:
Scale was zeroed to start the test, 4 Pumps ran for 1 minute, End scale reading was 5000lbs divided by 8.33 showed a flow of 600GPM
Each pump was able to produce 150GPM

4 Pumps pumping into a 3inch lines, supplying a 4 way Siamese into a 5inch line.
4 Pumps pumping into a 3inch lines, supplying a 4 way Siamese into a 5inch line.

Test 2:

This test was conducted with 2 pumps with 3” (25ft) discharge hoses into the 4 way Siamese which supplied a 5” (50ft) hose that was connected to a 5” elbow that emptied into the scale tank. The other two pumps were discharged directly into the scale tank using a 3” discharge hose (25ft).

Test 2 Results:

Scale was zeroed to start the test, 4 pumps ran for 1 minute, End scale reading was 6280lbs divided by 8.33 showed a flow of 753GPM

Based on test 3 below, it was determined that a single pump using 25ft of 3” discharge hose can produce approximately 204 GPM. So with that flow removed (408GPM) from this test, the two lines pumping though the Siamese were able to generate 345GPM total or 172GPM per pump.

Test 3

This test was conducted with 4 pumps with 3” (25ft) discharge hoses pumping directly into the scale tank.

Test 3 Results:

Scale was zeroed to start the test, 4 pumps ran for 1 minute, End scale reading was 6800lbs divided by 8.33 showed a flow of 816GPM

Each pump was able to produce 204GPM
Test 4

This test was conducted with 1 pump with 5” (50ft) discharge hose pumping directly into the scale tank. (This test was conducted for 3 minutes)

Test 4 Results:

Scale was zeroed to start the test, 1 pump ran for 3 minutes, End scale reading was 6320lbs divided by 8.33 showed a total Flow of **252GPM**

Summary:

The 3” semi-trash pumps used for this test are rated for 264 GPM. The impeller and casing design of a trash pump works to promote volume but will struggle to maintain its rated flow when back pressure is introduced into the discharge stream. This is mainly due to the larger impeller clearances that are needed to pass solids (as is the intent of a “trash” pump). This test has demonstrated that the overall flow to supply a fire scene can be increased by over 400 GPM when larger individual lines are used to discharge each pump rather than using an appliance (wye or siamese) to join the water streams into one stream. Using individual larger discharge hoses will allow the pumps to operate very close to their rated capacity.

Prepared by:  Jim Delman, BCTTF Coordinator, Fire Chief Sunset Heights Fire Dept.
Matt Otto, BCTTF WSO, Fire Chief Wolfhurst Fire Dept.