APPARATUS SERVICE TESTING

Equipment Required:

1. Smooth bore tips of a size sufficient for the anticipated flow (GPM). Three or Four inlet multi-universal. Note: Larger capacity pumps will require two multi-universals and sets of tips

2. Akron Brass’s Apparatus Flow Test Kit with proper smooth bore tips which gives UL Certified flows. Note: Nozzle pressure reading should be between 60-70 PSI ideally, but never under 50 PSI or over 100 PSI Note: Gauge from Apparatus Flow Test Kit can be remote mounted to the TGK-3 Test Gauge Panel

3. Akron Brass’s Hand Held Pitot if Apparatus Flow Test Kit is not used. Gauge is a 3-1/2” with a 0-160 PSI scale in two (2) pound increments and certified to be accurate to 1% of PSI reading full scale

4. Akron Brass’s TGK-2 or TGK-3 pump test gauges for hanging at operators panel with 1/4” connecting hoses to the UL vacuum and pressure test fitting plate on the operators panel pump test gauges:
   - Vacuum Test Gauge, 3-1/2” with a 0-30” in. scale in one (1) pound increments and certified to be accurate to 1% of in. reading full scale
   - Pressure Test Gauge, 3-1/2” with a 0-300 PSI scale in five (5) pound increments and certified to be accurate to 1% of PSI reading full scale

5. Akron Brass’s HT-4000 Hand Held Mechanical RPM counter Note: On new apparatus the half speed counter is optional

6. Copy of “Typical Hose Layout & Tip Sizes” see attached

7. Copy of “Annual Pump Service Test” see attached

8. Copy of “Discharge Table For Circular Outlets” see attached

9. Clipboard, pens & pencils, stop watch and any other items you might require

Service Testing Pumper Apparatus:

1. Purpose of Test:
   A. To insure the pump and its accessories will perform as required
   B. To expose defects or problems before causing an interruption of service
   C. To illustrate and record the performance history of the apparatus being tested

2. Frequency of the Service Test:
   A. Every 12 months
   B. After extensive repairs to the engine, drive train or pump

3. Conditions of Test:
   A. From Draft
   B. Lift not to exceed 10 feet through 20 feet of hard suction hose plus strainer

4. Performance Measurements:
   A. Discharges (GPM) at Net Pump Pressure (NPP) for a given period of time
   B. Gauge accuracy should be 1% full scale
   C. Engine RPM; Engine Oil Pressure and Engine Temperature

5. Sequences of Service Test and Test Procedures:
   A. Run a Dry Vacuum Test:
      1. Drain pump
      2. Connect 20 foot of Hard Suction Hose to the pump inlet and put the suction cap on the other end
      3. Run primer to develop a vacuum 22” in.
      4. Hold dry vacuum test for 10 minutes (a drop of 10 in. over 5 minutes is acceptable)
B- Priming Test
   1- Close all valves, drains, etc.
   2- Transfer valve to be set to volume position if a two stage pump
   3- Engage primer and pull a prime in 30 seconds for pump capacities of 1250 GPM or less and in 45 seconds for pumps with a capacity of 1500 GPM or more

C- Capacity Test (100% of pump’s rated GPM @ 150 PSI Net Pump Pressure (NPP):
   1- Have the proper number of 2-1/2” hoses connected to pump discharges, and have the discharge valve open.
   2- Increase RPM to proper setting
   3- Maintain RPM while developing
      a- 150 PSI Net Pump Pressure (NPP)
      b- 100% rated GPM of the pump
   4- Duration of test - 20 minutes
   5- Measurements to be taken and recorded at the start of this test and at 5 minute intervals
      a- 1/2 Speed Counter reading
      b- Tachometer reading
      c- Pump PSI reading
      d- Pump in. Reading
      e- Pitot Gauge Reading
      f- Pump Mode
      g- Tip Size
      h- Layout of hose lines

D- Automatic Pump Pressure Control Test:
   1- While pumping 100% rated GPM of the pump, engage pressure control device and set to maintain pressure at 150 PSI Net Pump Pressure
   2- Slowly close all discharge valves
   3- Pressure surge should be no more than 30 PSI

E- Overload Test:
   1- Open an adequate number of discharge valves
   2- Increase discharge to 100% rated GPM at a discharge pressure of 165 PSI Net Pump Pressure
   3- Duration of test - 5 minutes
   4- Measurements to be taken and recorded as in (C-5 above) at start of the test and 5 minute intervals

F- Automatic Pump Pressure Control Test:
   1- While pumping 100% rated pumps rated capacity, engage pressure control device and set to maintain pressure at 90 PSI Net Pump Pressure
   2- Slowly close all discharge valves
   3- Pressure surge should be no more than 30 PSI

G- 70% Test:
   1- Open an adequate number of discharge valves
   2- Place transfer valve in proper mode of operation (two stage pumps)
   3- Increase RPM to proper setting
   4- Maintain RPM while developing
      a- 200 PSI Net Pump Pressure (NPP)
      b- 70% rated GPM of the pump
   5- Duration of test - 10 minutes
   6- Measurements to be taken and recorded as in (C-5 above) at start of the test and 5 minute intervals

H- 50% Test:
   1- Open an adequate number of discharge valves
   2- Place transfer valve in proper mode of operation (two stage pumps)
   3- Increase RPM to proper setting
   4- Maintain RPM while developing
      a- 250 PSI Net Pump Pressure (NPP)
      b- 50% rated GPM of the pump
H- 50% Test Con’t:
5- Duration of test - 10 minutes
6- Measurements to be taken and recorded as in (C-5 above) at start of the test and 5 minute intervals

I- Automatic Pump Pressure Control Test:
1- While pumping 50% rated GPM of the pump, engage pressure control device and set to maintain pressure at 250 PSI Net Pump Pressure.
2- Slowly close all discharge valves
3- Pressure surge should be no more than 30 PSI.

J- Tank-To-Pump Test (Optional):
1- Maintain a full water tank by supplying it from an outside source of water (hydrant)
2- Open tank to pump valve(s) and develop a GPM discharge flow from the pump required for the size (capacity in gallons) of the tank
3- After GPM flow is established, close off outside water source to the tank
4- Start timing to determine rate of flow from tank to pump

<table>
<thead>
<tr>
<th>Rate of Flow</th>
<th>Capacity of Tank</th>
</tr>
</thead>
<tbody>
<tr>
<td>250 GPM (4.16 gallons / second)</td>
<td>300-750 gallons</td>
</tr>
<tr>
<td>500 GPM (8.30 gallons / second)</td>
<td>750 gallons of larger</td>
</tr>
</tbody>
</table>

5- Flow must be maintained for at least 80% of the capacity of the tank.

**COMPUTING PERFORMANCE**

**A** - Net Pump Pressure (NPP) is the measurement of the total amount of work performed by the pump:
1- To lift the water into the pump
2- To discharge the water from the pump

**B** - Allowances are made for:
1- Height of lift
2- Friction Loss in the Hard Suction Intake hose plus the strainer

**C** - Measuring the Amount of Lift:
1- Measuring difference in elevation between surface or water and the pump intake in feet
2- Converting vacuum gauge reading in feet of lift
   a- Multiply gauge reading (inches of in.) by 1.13
   b- Result is the difference in elevation (in feet)

**D** - Find Hard Suction Intake Hose Friction Loss from the Below Table:
1- Identify the rated GPM (capacity) of the pump to be service tested
2- Identify the hard suction hose diameter to be used
3- Identify from the below table the friction loss in 20 feet of hard suction hose

<table>
<thead>
<tr>
<th>GPM of Pump</th>
<th>Diameter of Suction Hose in Inches</th>
<th>One 10’ Length of Hard Suction Hose</th>
<th>Each Additional 10’ Length of Suction Hose</th>
</tr>
</thead>
<tbody>
<tr>
<td>500</td>
<td>4”</td>
<td>6 PSI</td>
<td>+ 1 PSI</td>
</tr>
<tr>
<td></td>
<td>4-1/2”</td>
<td>3-1/2 PSI</td>
<td>+ 1/2 PSI</td>
</tr>
<tr>
<td>750</td>
<td>4-1/2”</td>
<td>7 PSI</td>
<td>+ 1-1/2 PSI</td>
</tr>
<tr>
<td></td>
<td>5”</td>
<td>4-1/2 PSI</td>
<td>+ 1 PSI</td>
</tr>
<tr>
<td>1000</td>
<td>5”</td>
<td>8 PSI</td>
<td>+ 1-1/2 PSI</td>
</tr>
<tr>
<td></td>
<td>6”</td>
<td>4 PSI</td>
<td>+ 1/2 PSI</td>
</tr>
<tr>
<td>1250</td>
<td>5”</td>
<td>12-1/2 PSI</td>
<td>+ 2 PSI</td>
</tr>
<tr>
<td></td>
<td>6”</td>
<td>6-1/2 PSI</td>
<td>+ 1/2 PSI</td>
</tr>
<tr>
<td>1500</td>
<td>6” - 5”</td>
<td>9 PSI</td>
<td>+ 1 PSI</td>
</tr>
<tr>
<td></td>
<td>(2) - 5”</td>
<td>7 PSI</td>
<td>+ 1 PSI</td>
</tr>
<tr>
<td>1750</td>
<td>6” - 6”</td>
<td>12-1/2 PSI</td>
<td>+ 1-1/2 PSI</td>
</tr>
<tr>
<td></td>
<td>(2) - 6”</td>
<td>3 PSI</td>
<td>+ 1/2 PSI</td>
</tr>
<tr>
<td>2000</td>
<td>(2) - 5”</td>
<td>8 PSI</td>
<td>+ 1-1/2 PSI</td>
</tr>
<tr>
<td></td>
<td>(2) - 6”</td>
<td>4 PSI</td>
<td>+ 1/2 PSI</td>
</tr>
</tbody>
</table>
E- Calculating Pump Discharge Pressure for Service Test (PDP):
   1- Work Performed on the Discharge side of the pump is indicated on the pump discharge gauge.
   2- Work performed on the Suction side of the pump is determined by computing the following formula (work
      is measured in PSI)
      \[
      \text{Pressure Correction} = \frac{\text{Height of lift (ft.)} + \text{Intake hose friction loss (from table)}}{2.3 \text{ (constant to convert feet to PSI)}}
      \]
   3- To determine the Pump Discharge Pressure (PDP) used for a service test, the Pressure Correction must be
      subtracted from the Net Pump Pressure (NPP).
      \[
      \text{PDP} = \text{Net Pump Pressure (NPP)} - \text{Pressure Correction (suction work)}
      \]
   4- Pressure Correction for the three performance test are:
      \[
      \begin{align*}
      &\text{100\% rated GPM} & \text{Pressure Correction as calculated} \\
      &\text{70\% rated GPM} & \text{Pressure Correction Minus 1 PSI} \\
      &\text{50\% rated GPM} & \text{Pressure Correction Minus 2 PSI}
      \end{align*}
      \]
      Example: A 1000 GPM pumper is to be Service Tested.
      What are the desired readings on the pump discharge gauge for the following test?
      The pumper is (2) 10 foot lengths of 5" hard suction hose. After priming the pump
      the Vacuum Gauge reads 8.5 in.
      Steps:
      1- Find the lift 8.5 in. x 1.13 feet = 9.6 feet
      2- Find the Friction Loss in the two (2) lengths of hard suction hose. = 9.5 PSI
         (Use Friction Loss Chart for Hard Suction Hose).
      3- \[
      \text{Pressure Correction} = \frac{9.6 \text{ feet} + 9.5 \text{ feet}}{2.3 \text{ feet}}
      \]
      4- Solve for Pump Discharge Pressure (PDP):
         \[
         \begin{array}{ccc}
         \text{NPP} & \text{Pressure Correction} & \text{PDP} \\
         \text{100\% Test at} & 150 \text{ PSI} & 8.3 \text{ PSI} & 142 \text{ PSI} \\
         \text{70\% Test at} & 200 \text{ PSI} & 8.3 - 1 \text{ for % gauge error} & 193 \text{ PSI} \\
         \text{50\% Test at} & 250 \text{ PSI} & 8.3 - 2 \text{ for % gauge error} & 244 \text{ PSI}
         \end{array}
         \]

CORRECT USE OF THE HAND HELD PITOT:

Using Akron Brass's -Hand Held Pitot for taking a flow reading is not difficult, but it is essential that it is used properly
if accurate readings are to be obtained. Akron Brass's -Hydrant or Apparatus Flow Test Kit's may also be used.

A good method of holding the hand held pitot tube is to stand on the right hand side of the water stream with the pitot in
your right hand, and your right thumb above the air/water bleed button. Hook three fingers of the left hand over the handle
of the pitot between the pitot blade and gauge. As you insert the blade into any water stream use extreme caution as the
pitot will kick back on the employee. It takes practice to be able to hold the tip of the blade in the center of the water
stream. You must steady the Hand Held Pitot or the force of the water will make it impossible to get an accurate reading.

The procedure for using the Akron Brass Hand Held Pitot With Gauge are as follows:
   1- After obtaining a secure grasp of the pitot tube, press the air/water bleed button with your thumb as the pitot
tube is being placed in the water stream. This removes all air from the static pressure circuit of the pitot.
      Because the 3-1/2 inch pressure gauge is liquid filled, your needle fluctuation is basically nonexistent.
   2- The pitot blade tip opening should be placed in the center of the water stream and held away from the
      hydrant outlet or nozzle tip, approximately one-half the diameter of the opening, i.e. for a 2-1/2 inch
      (65 mm) outlet the distance would be 1-1/4 inches (32 mm).
   3- Read the pressure gauge and record the pressure reading. Next, look up the PSI or (kPa) reading in the
      attached table for gallons per minute GPM or (kPa) flow.
   4- After the test is complete, press the air/water bleed button to allow all water to drain before storing the hand
      held pitot in its case.
ANNUAL PUMP SERVICE TEST

Name: __________________________________________ Date: ______________________
                                                                                      Tested By: ______________________

Apparatus Information:

<table>
<thead>
<tr>
<th>Year:</th>
<th>Make:</th>
<th>Model:</th>
<th>Serial #:</th>
<th>Unit #:</th>
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<tbody>
<tr>
<td>Engine Make:</td>
<td>Engine Model:</td>
<td>Engine Serial #:</td>
<td>Engine Hours:</td>
<td>Mileage:</td>
</tr>
<tr>
<td>Pump Make:</td>
<td>Pump Model:</td>
<td>Pump Serial #:</td>
<td>Pump Hours:</td>
<td>Pump Capacity:</td>
</tr>
</tbody>
</table>

Gear Ratio: Engine to Pump:  Capacity  70%  50%  Hand Speed Counter Ratio to Engine:

Transmission Gear Used:  Capacity  70%  50%

Test Conditions:

Dry Pump Primed in __________ seconds  Atmospheric Pressure: ______________________

Hard Suction Hose Size: _______  Temperature:  Air: _______ Water: _______

Lift from water level to the middle of suction intake manifold on apparatus: Feet: _______ Inches: _______

Location of test site: ______________________

Engine Oil Pressure: _______________  Engine Water Temperature: _______________

**FIRST TEST  150 PSIG:**

<table>
<thead>
<tr>
<th>Time</th>
<th>1/2 Speed Counter</th>
<th>Tach. Reading</th>
<th>Pump PSI Reading</th>
<th>Pump in. Reading</th>
<th>Pilot Gauge Reading</th>
<th>Pump Mode</th>
<th>Tip Size</th>
<th>No:</th>
<th>Hose Layout Size:</th>
<th>Lengths:</th>
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</thead>
<tbody>
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**SECOND TEST  165 PSIG:**

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<tr>
<th>Time</th>
<th>1/2 Speed Counter</th>
<th>Tach. Reading</th>
<th>Pump PSI Reading</th>
<th>Pump in. Reading</th>
<th>Pilot Gauge Reading</th>
<th>Pump Mode</th>
<th>Tip Size</th>
<th>No:</th>
<th>Hose Layout Size:</th>
<th>Lengths:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start</td>
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</table>

**THIRD TEST  200 PSIG:**

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<th>Time</th>
<th>1/2 Speed Counter</th>
<th>Tach. Reading</th>
<th>Pump PSI Reading</th>
<th>Pump in. Reading</th>
<th>Pilot Gauge Reading</th>
<th>Pump Mode</th>
<th>Tip Size</th>
<th>No:</th>
<th>Hose Layout Size:</th>
<th>Lengths:</th>
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<tbody>
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<tr>
<td>Time</td>
<td>1/2 Speed Counter</td>
<td>Tach. Reading</td>
<td>Pump PSI Reading</td>
<td>Pump in. Reading</td>
<td>Pilot Gauge Reading</td>
<td>Pump Mode</td>
<td>Tip Size</td>
<td>No.</td>
<td>Hose Layout</td>
<td>Size:</td>
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</tbody>
</table>

NOTES: __________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________

UNIT PASSED  UNIT FAILED

TESTED BY: _____________________________________________________
SIGNED PRINT NAME: TITLE

WITNESSED BY: _________________________________________________
SIGNED PRINT NAME: TITLE
## APPARATUS SERVICE TESTING TYPICAL HOSE LAYOUT & TIP SIZES

<table>
<thead>
<tr>
<th>PUMP SIZE</th>
<th>PUMP PRESSURE</th>
<th>GPM</th>
<th>HOSE LAYOUT USING 2-1/2&quot; HOSE</th>
<th>PITOT PRESSURE</th>
<th>ACTUAL GPM FLOW</th>
<th>TIP SIZE</th>
<th>SUCTION HOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>250</td>
<td>150</td>
<td>250</td>
<td>One (1) 50' Line</td>
<td>46</td>
<td>251</td>
<td>1-1/8&quot;</td>
<td>4&quot;</td>
</tr>
<tr>
<td></td>
<td>200</td>
<td>175</td>
<td>One (1) 50' Line</td>
<td>64</td>
<td>175</td>
<td>7/8&quot;</td>
<td>4&quot;</td>
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<tr>
<td></td>
<td>250</td>
<td>125</td>
<td>One (1) 50' Line</td>
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<td>124</td>
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<td>4&quot;</td>
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<td>500</td>
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<td>508</td>
<td>1-1/2&quot;</td>
<td>4&quot;</td>
</tr>
<tr>
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<td>200</td>
<td>350</td>
<td>One (1) 50' Line</td>
<td>58</td>
<td>350</td>
<td>1-1/4&quot;</td>
<td>4&quot;</td>
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<td>250</td>
<td>250</td>
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<td>252</td>
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<td>750</td>
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<td>750</td>
<td>Two (2) 100' Lines</td>
<td>68</td>
<td>575</td>
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<td>4-1/2&quot;</td>
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<td>360</td>
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<td>One (1) 100' Line</td>
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<td>501</td>
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<td>5&quot;</td>
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<td>1258</td>
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<td>Two (2) 100' Lines</td>
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<td>627</td>
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<td>6&quot;</td>
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### 1750 THROUGH 2500 GPM PUMPS REQUIRE TWO (2) DELUGE SETS, TWO (2) GFE FLOW KITS, MEASURE PSI, AND DUAL 6" SUCTION HOSES

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