

# Egg Harbor Fire Department and First Responders Standard Operating Guideline

**Subject: BASIC PUMPING**

**SOG 307**

**Purpose:** This standard establishes a guideline for pumping with Egg Harbor Fire Department apparatus.

**Scope:** This procedure applies to all members of the Egg Harbor Fire Department.

## **Definitions:**

- 1. Appliance** – A device, other than a hand held nozzle, where the direction of water flow is interrupted or changed.
- 2. Bleeder Valve** - Valve on a gate that allows air from an incoming supply line to be bled off before allowing the water into the pump.
- 3. Compound or Vacuum Gauge** – A gauge capable of measuring positive or negative pressures. This is the gauge that measures the intake pressure on a pump.
- 4. Cavitation** – A condition that is created by water vapor bubbles (air) in the pump.
- 5. Centrifugal Pump** – A non-positive displacement pump where water is introduced at the center of a revolving impeller, and moved outward. Cannot pump air.
- 6. Discharge** - Valve used to move water from the pump to the hose line.
- 7. Discharge Gauge** - Shows the operator the pressure at each of the discharge valves being used.
- 8. Drain** - Valve used to drain water from piping and pumps.
- 9. Engine Pressure** - The actual pressure at the pump panel.
- 10. Friction Loss** - The part of the total pressure lost due to turbulence of water moving against the interior surfaces of pipes, hose, and appliances.
- 11. G.P.M.** – Gallons per minute.
- 12. Gutter Line (recirculation line)** – A hand line used to flow water so the pump does not overheat.
- 13. Intake** - Valve used to allow water to enter the pump.
- 14. Master Gauge** - Shows the highest pressure being pumped.
- 15. Master Stream** - Any fire stream that is flowing over 350 gpm.
- 16. Nozzle Pressure** – Pressure at which water is being discharged from the nozzle.
- 17. Pressure** – A measure of the energy contained in water and is stated in pounds per square inch (psi).
- 18. Primer** – A small positive displacement pump that removes air from the main pump allowing for it to receive water from a static water source.

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- 19. Pressure Governor**-Pressure control device that controls engine speed. Designed to eliminate a hazardous condition resulting from excessive pressures.
- 20. Pressure Relief Valve**- Automatic device designed to release excess pressure from a pump while multiple lines are flowing.
- 21. Pump Shift Override**- Allows the operator to bypass the electric/air pump shift control and engage the pump manually.
- 22. Residual Pressure** - Pressure left over in a water system after water is flowing.
- 23. RPM Gauge** - Revolutions per minute of the motor.
- 24. Static Pressure** - Water pressure available in a system prior to water flowing.
- 25. Tank to Pump Valve** –Valve that allows water from the tank into the pump.
- 26. Tank Fill Valve** – Valve that allows the operator to fill the booster tank from water coming in to the pump. Can also be used to recirculate water, to cool the pump.
- 27. Water Hammer** – The concussion effect of a moving stream of water, when its flow is suddenly stopped.
- 28. Water Temperature Gauge** - Allows the operator to monitor the water temperature of the engine.

### **Pump and Tank Capacities**

- Engine 5** - 1250 GPM 1000 Gallons  
**Engine 6** - 1500 GPM 1000 Gallons 20 Foam  
**Ladder 21** -2000 GPM 500 Gallons 20 Foam  
**Truck 20** - 120 GPM 180 Gallons 5 Foam  
**Engine 7** – 1000 GPM 2100 Gallons

### **Placing Pump in Gear**

1. Bring apparatus to full stop. Come to idle speed.
2. Shift transmission to neutral. Set the parking brake.
3. Chock the wheels.
4. Operate pump shift device.
5. Look at the PUMP ENGAGED indicator light. The indicator light should turn on.
6. Shift road transmission into Drive (D).
7. Check speedometer, it should indicate approximately 12 to 18 MPH.
8. The OK TO PUMP light should be turned on.
9. Supply water to pump and circulate water to keep pump from overheating.
10. If air temperature is above 80degrees F. or if engine overheats open the ENGINE COOLER valve.

## **Two-Stage Pump Operation (Engine 6)**

1. Select either Volume or Pressure mode.
  - a. Shift the Transfer Valve to the VOLUME setting for high flow at moderate pressure.
  - b. Shift the Transfer Valve to the PRESSURE setting for moderate flow at high pressure.
  - c. Shift the Transfer Valve to the VOLUME setting when priming a two-stage pump.

## **Controlling Pump Discharge Pressure**

1. Controlling Engine Speed, Pumping-Pressure Governor Operation
  - a. Select pressure mode.
  - b. Adjust desired pressure.
2. Controlling Engine Speed, Not Pumping-Pressure Governor Operation
  - a. Select throttle mode.
  - b. Adjust desired engine speed (rpm).

## **Operating From the Booster Tank and Pressurized Water Source**

1. Place pump in gear by following procedure in **Placing Pump in Gear**.
2. Open tank to pump valve.
3. Set throttle to 1000 to 1200 rpm's
5. Engage primer (If needed)
  - a. Approximately 30 seconds for 1250 gpm pumps or less
  - b. Approximately 45 seconds for 1500 + gpm pumps
  - c. Add 15 seconds for front intakes
  - d. Engage primer until steady stream of water is flowing from the primer discharge hose.
  - e. Look for pressure reading on master gauge and vacuum on the compound gauge.
6. Be sure hose is clear of hose bed and hose crew is ready for water.
7. Slowly open appropriate discharge.
8. Increase the throttle control to desired pressure.
9. Set pressure control devices.
10. Connect supply line to intake valve.
11. Open bleeder (if available) to purge air and leave open until steady stream of water flows from the opening.

**The following procedures need to be done together to stop from losing pressure on the lines being supplied**

12. Open intake valve slowly. Close tank to pump valve slowly (This needs to be done simultaneously when possible).
13. Adjust throttle to maintain desired pressure.
14. Open "tank fill" valve to refill tank.
  - a. Partially open tank fill valve to recirculate water when no water is flowing, or use a gutter line.
  - b. Check all gauge readings

**Operating from a Static (Draft) Water Supply**

1. Place pump in gear by following procedure in **Placing Pump in Gear**.
2. Close all valves.
3. Attach suction hose to pump.
  - a. Suction hose should be even to or lower than the intake.
  - b. Ensure that all connections are tight.
  - c. Use the front or opposite side intake if possible (front intake piping reduces capacity).
4. Switch pressure governor to THROTTLE mode.
5. Increase engine speed to 1000rpm.
6. Open primer valve by pulling primer handle.
  - a. Approximately 30 seconds for 1250 gpm pumps or less
  - b. Approximately 45 seconds for 1500 + gpm pumps
  - c. Add 15 seconds for front intakes
7. Watch for pressure on the Master Pressure Gauge for pressure to begin to rise.
8. Open the discharge valve slowly to begin water flow operation.
9. Switch pressure governor to THROTTLE mode.
10. Increase pressure to desired discharge pressure.
11. If pump fails to prime, check for the following:
  - a. Air leaks
  - b. Debris on strainer
  - c. Oil level low in priming tank
  - d. Defective priming valve
  - e. Drafting lift to high
  - f. Not enough water above strainer- may cause whirl pooling
  - g. Hard sleeve higher than intake
  - h. Primer not activated long enough
12. Maintenance after drafting:
  - a. Refill primer oil (if applicable)
  - b. Back flush pump with clean water

## Shutting Down Procedures

1. Reduce throttle control to idle.
2. Close discharge valves.
3. Make sure tank is full of water.
4. Close intake valves.
5. Place transmission in neutral.
6. Wait for engine speedometer to go to zero.
7. Operate pump shift device.
8. Observe indicator lights. PUMP ENGAGED and OK TO PUMP lights should be off.
9. Shift gear selector to drive before reverse.

### Foam Procedure for E-6

1. Place pump in gear by following procedure in **Placing Pump in Gear**.
2. Open tank to pump valve.
3. Prime pump.
4. Press the RED button on the foam flow display.
5. Press the menu button (white/gray button) and select %.
6. Select the proper foam percentage using the up arrow.
7. The bar light will indicate that you are ready to flow foam.
8. Open the discharge to flow foam.

#### After using foam

9. Press the RED button on the foam flow display.
10. Open the foam flush for 3-5 minutes.
11. Close foam flush.
12. Close discharge.

### Foam and CAFS Procedure for Ladder – 21

1. Place pump in gear by following procedure in **Placing Pump in Gear**.
2. Make sure the CAFS mode switch is in the FOAM position and that all CAFS air discharge supply valves are in the CLOSED position.
3. Turn air compressor on.
4. Open tank to pump valve.
5. Prime pump.
6. Turn foam system on.
7. Begin flowing water, foam pump will activate.
8. Increase pump pressure to approximately 100psi pump pressure (**150 PSI MAXIMUM**).
9. Use the up/down buttons to change percentage (*if needed*).

10. Partially open the desired discharge, using the pull handle (*Water discharge valves need not be fully opened with CAFS, which allows for “dryer” or “wetter” foam. Experience will guide the operator on the degree to which water discharge valves are opened.*).
11. Open the CAFS air valve to the desired discharge (*switch by discharge handle*). You are now flowing compressed air foam.

#### **After using foam**

1. Close air discharge valve.
2. Turn foam system off.
3. Flush hoselines until mostly free of bubbles.
4. Close discharges.
5. Open the manifold drains to relieve trapped air pressure. OPEN VALVES SLOWLY.

#### **Drafting class A foam**

1. Set up for drafting operation by positioning foam and hooking up pick-up hose.
2. Press MODE until the DRAFT CLASS A screen appears, and then press ENTER. On-board tank valves will close, causing suction to draw from foam inlet.
3. The default percentage will remain the same as the on-board Class A tank current setting.
4. Use the arrow up/down buttons to change percentage (*if needed*).

#### **Filling class A foam tank**

1. Place pump in gear by following procedure in **Placing Pump in Gear**.
2. Turn foam system on.
3. Attach pick-up hose to foam pump inlet.
4. Turn the selector valve to the TANK FILL position.
5. Press MODE until the TANK A FILL screen appears. Press ENTER.
6. The float switch in foam tank dome will automatically stop the fill process.
7. Return selector switch to the INJECT MODE position.

#### **Steps for Back Flushing Pumps**

1. Shut off the apparatus.
2. Open all discharges and intakes.
3. Remove all intake screens.
4. Place a supply line in the upper most discharge.
5. Charge the supply line.
6. Let water flow from all intakes for at least 5 minutes.
7. Shut off supply line.
8. Replace screens in intakes.
9. Close all discharges.
10. Refill booster tank.

## **Guidelines for Draining Pumps**

1. When the temperature is predicted to be below 25°F for an extended period of time (Daytime Highs).
2. Anytime the temperature is predicted to be or drops below 15°F.
3. When a piece of apparatus is going to be outside for an extended period of time with the temperature below freezing (32°F), with or without the engine running.
4. Anytime at the discretion of an Officer.

## **Steps for Draining Pumps**

1. Shut tank- to- pump valve.
2. Open master drain.
3. Remove all caps and pre-connected hose lines (intake & discharge).
4. Open all individual discharge and intake valves.
5. Open all individual drains.
6. Open all inline drains (intake and discharge).
7. Wait till water has stopped flowing (maybe as long as 10-15 minutes).
8. Close all valves.
9. Cap all discharges, intakes, and reconnect all hose lines.
10. Close all drains.
11. Add antifreeze to pump.
12. Make notification to the department members that pumps have been drained.
13. When the pump is recharged with water make sure that the tank is topped off. (The average pump holds 50-75 gallons of water, depending on piping)

## **Operating from a Hydrant**

1. Flush the hydrant before hooking up lines
2. Obtain static pressure reading after hydrant is charged
3. Residual pressure should be noted each time a hose line is charged.

## **Dump Tank Transfer**

When 2 or more dump tanks are set up, the easiest way to pump out of all of them is to do a dump tank transfer. By doing this you will not have to move the hard sleeve from one tank to the others. First place one end of a hard sleeve in the dump tank you want to run water from into the tank you are pumping from. Then you will need to run an 1 3/4" hose from the engine to the end of the hard sleeve in the tank you want to pull water from. Charge the hose to 50 psi. This should cause water to flow into the tank you are pumping from.

## **Standards and Measurements**

One gallon of fresh water weighs 8.33 pounds (use 8.3 in formulas.)  
Atmospheric pressure at sea level is 14.7 psi.

50 foot section of 1 3/4 inch hose contains 6.24 gallons.  
50 foot section of 2 1/2 inch hose contains 12.75 gallons.  
50 foot section of 3 inch hose contains 18.3 gallons.  
100 foot section of 5 inch hose contains 102 gallons. (Approx. 950 lbs.)  
100 foot section of 5 inch hose uncharged weighs approx. 103 lbs.

## Friction Loss

### Formula Method:

$$FL = CQ^2 L$$

FL= Friction loss in psi

C= Coefficient – from a predetermined chart

Q= Quantity – GPM divided by 100

L= Length – length of hose divided by 100

Pump Discharge Pressure= Nozzle Pressure+ Friction Loss

### Coefficients:

1 3/4"- 15.5

2 1/2"- 2

3"- .8

5"- .08

### Nozzle Pressures:

All standard Fog: 100 psi

All low pressure Fog: 50 psi.

Smooth bore (handline): 50 psi

Smooth bore (masterstream): 80 psi

### Standard Tip Sizes:

Tip Size GPM

7/8"- 160

15/16"- 185

1"- 200

1 1/8"- 250

1 1/4" (handline) -325

1 1/4" (master stream) - 400

1 3/8"- 500

1 1/2"- 600

1 3/4"- 800

2 "-1000

### Appliances: Rules of thumb to remember are:

- 10 psi FL. for hose appliances, such as wyes and siamese.
- Insignificant for flows < 350gpm.

### Elevation:

- add 5 psi of friction loss per story

- add or subtract .5 lbs. of friction loss per foot of elevation