ENGINE PUMPS

Biz, 08/28/01

Short Version:

Q: How much pressure should I set the pump at?

A: 100 psi

Long version:

"Quick, get water on it" = Preconnected 1.5" handline with fog nozzle.

Fog nozzles usually want **100 psi** (pounds/sq.in.) to deliver rated flow, usually 125 gpm (gallons/minute).

Four factors will cause pressure to drop between pump and nozzle:

1. Kinks in the hose. Probably #1 cause of pressure drop on scene. This is the only one you can mitigate.

2. Elevation. As you go down a water column, pressure increases at 0.4 psi/foot. Going up a column, pressure goes down. If nozzle is above engine by X feet, assume pressure is lower by X/2 (or so). Example: Nozzle is uphill from engine, by 30 feet (measured vertically). Pressure at nozzle will be about 15 psi lower than pump pressure gage (OK, 13 psi due to elevation alone).

3. Appliance pressure drop. All gated wyes, connections, reducers, expanders etc. This is generally not a problem unless flows are very high, > 350 gpm. (Comparison- this would empty E1 in one minute, T3 in 4 or 5 minutes). If flows are high, assume 10 psi loss per appliance.

4. Hose friction loss. The longer the hose, the more pressure is lost. The higher the flow rate, the more pressure is lost, squared!

$$\text{Friction Loss} = \text{a Constant} * \text{Length} * \text{Flow rate}^2$$

$$FL = CLQ^2$$

	Friction loss per 100 feet:	
Q: gpm	1.5" dia	2.5" dia
50 gpm	-6 psi	-1 psi
60 gpm	-9 psi	-1 psi
80 gpm	-15 psi	-1 psi
100 gpm	-24 psi	-2 psi
120 gpm	-35 psi	-3 psi
150 gpm	-54 psi	-5 psi
200 gpm	-96 psi	-8 psi
250 gpm	-150 psi	-13 psi
300 gpm	-216 psi	-18 psi
500 gpm	-600 psi	-50 psi
	C=24	C=2

Friction = C*(Q/100)^2
Want 100 psi at nozzle
Want 20 psi at next pump
Elevation loss = 0.5 psi/foot
Wye, etc. = 10 psi for Q>350

Tricky example: You have 200 feet of 2.5" hose, going uphill 50 feet to a gated wye. Two 1.5" handlines are connected. One is 100 feet long, the other is 200 feet long. What pressure should you set?

Answer: Set the pressure for the hose line with the most drop (ignore the other one in your calculation), then use the gate on the wye to throttle the other one, if needed.