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Use this worksheet to follow along with our Pump Operator Series training videos. We will review the basics and also practice several problems. Below we have provided you with the common formulas you will use to solve friction loss problems and to create custom pump charts for your own use.

Abbreviations

PDP = Pump Discharge Pressure

GPM = Gallons per minute

FL = Friction Loss

TPL = Total Pressure Loss

C = Coefficient

Q = Quantity of Water in 100's of GPM (GPM/100)

L = Length of Hose in 100's of Feet (Length/100)

d = Diameter

NP = Nozzle Pressure

AL = Appliance Loss

ELEV = Elevation Gain or Loss

Formulas

$$FL = C \times Q^2 \times L$$

$$PDP = TPL + NP$$

$$TPL = FL + AL + ELEV \pm$$

$$GPM = 29.7 \times d^2 \times \sqrt{NP}$$

General Rules of Thumb

Elevation

- Add 5 PSI per 10ft. of Elevation Gained.
- Subtract 5 PSI for every 10ft. of Elevation Loss.
- Add 5 PSI for every upper floor of a building but do not count the 1st Floor.
- Divide the height of an Aerial in half to get the PSI lost in Elevation of an Aerial Device.
- Add 10 PSI for every appliance if more than 350 GPM is flowing through it.
- Add 25 PSI for Master Streams regardless of flow.

Nozzle Operating Pressures

Fog/Combination = 100 PSI

- This varies depending on your nozzle type but 100 PSI is a common pressure.

Smoothbore Hand-line = 50 PSI

Smoothbore Master Stream = 80 PSI

Friction Loss Coefficients

HOSE DIAMETER	COEFICIENT
1" Booster	150
1 1/2" Attack Line	24
1 3/4" Attack Line	15.5
2" Attack Line	8
2 1/2" Attack Line	2
3" with 2 1/2" Couplings	0.8
4" LDH	0.2
5" LDH	0.08
6" LDH	0.05