Pump Chart

Friction Loss per 100 feet of hose line

GPM	1 ½”	1 ¾”	2 ½”	3” w/2 ½” couplings	4”	5”
100	24	15.5	2	1		
125	38	24	3	1		
150	54	35	4	2		
200	96	62	8	3	0.8	
250		97	13	5	1.25	
300			18	7	1.8	
350			25	10	2.45	
400			32	13	3.2	
500			50	20	5	2
600			72	29	7.2	3
700				40	9.8	4
800					12.8	5
1000					20	8
1250					31	12
1500					45	18
2000					80	32

Siamese Lines – friction loss for two 2 ½” hose lines

GPM	100’	200’	300’	400’	500’
200	2	4	6	8	10
250	3	6	9	12	15
300	5	10	15	20	25
400	8	16	24	32	40
500	12	25	37	50	62
600	18	36	54	72	90
800	32	64	96	128	160
1000	50	100	150	200	250

Hand lines w/Smooth Bore Tip @ 50 psi NP **Master Stream @ 80 psi NP**

Tip size	GPM	FL/100’ 1¾” hose	Fl/100’ 2½” hose		Tip size	GPM
15/16”	165	42			1 3/8”	502
15/16”	185	53			1 ½”	598
1”	210		9		1 ¾”	814
1 1/8”	266		14		2”	1063
1 ¼”	328		22			

Friction Loss Constants

Appliances	+ 10 psi > 350 gpm
Master streams	+ 25 psi
Aerial waterway	+ 25 psi
Standpipes	+ 25 psi
Elevation	+/- 5 for every 10’ gain or loss
Sprinkler Systems	150 psi
Residual intake pressure	20 psi minimum
Maximum pump pressure	250 psi

Use AHJ department SOP’s/SOG’s for the following pumping procedures:

1. Foam operations
2. Aerial operations
3. Pre-connected hose line gpm standards
4. Nozzle pressures used as per manufacturer and AHJ

Class B Foam Operations:

1 3/4" hand line w/TFT Mid- Force Nozzle/ Eductor attached to the pump panel

GPM	Max Length	FL/100'	PP	**For remote operations add 2 psi FL for each 100' section of 2 1/2" Supply line**
95	250'	14	200 psi	
125	150'	24	200 psi	

Standards and Measurements: One gallon of fresh water weighs 8.33 pounds.

100' of 1 ½" hose = 9.14 gallons of water	100' of 2 ½" hose = 25.55 gallons of water
100' of 1 ¾" hose = 12.42 gallons of water	100' of 5" hose = 101 gallons of water

Hydrant Residual Performance: IFSTA Equation: $\frac{\text{(Static minus Residual) 100}}{\text{Static}}$

% drop	0 – 10%	11 – 15%	16 – 25%	25%
Additional GPM	3X	2X	1X	0

Calculating Friction Loss: PP = FL + NP + Appliance +/- Elevation

Friction Loss Formula: $FL = CQ^2L$

Abbreviations	**Definitions**		**Hose Diameter**	**Coefficients**
FL	Friction Loss in psi		¾" Booster	1.100
C	Friction Loss Coefficient		1" Booster	150
Q	GPM ÷ 100/ squared		1 ¼" Booster	80
L	Length of hose ÷ 100		1 ½" hose	24
			1 ¾" hose	15.5
PP	Pump Pressure		2 ½" hose	2
TPDP	Total Pump Discharge Pressure		2 ½" Siamese line	.5
			3" w/2 ½" couplings	0.8
			3" w/ 3" couplings	0.677
			4" hose	0.2
			5" hose	0.08
			4" Standpipe	0.374
			5" Standpipe	0.126
			6" Standpipe	0.052

Calculating GPM for Smooth Bore nozzles: **Formula:** $GPM = 29.7 \times d^2 \times \sqrt{NP}$

Abbreviations	**Definitions**		**Decimal Equivalents**			**Square Roots**	
GPM	Discharge in GPM		1/8"	.125		20	4.472
29.7	A constant (round to 30)		1/4"	.25		30	5.477
D	Diameter of orifice in inches		3/8"	.375		40	6.324
√NP	Square root/ nozzle pressure in inches		1/2"	.5		50	7.07
			5/8"	.625		60	7.745
			3/4"	.75		70	8.366
			7/8"	.875		80	8.944
			15/16"	.9375		90	9.486
						100	10