



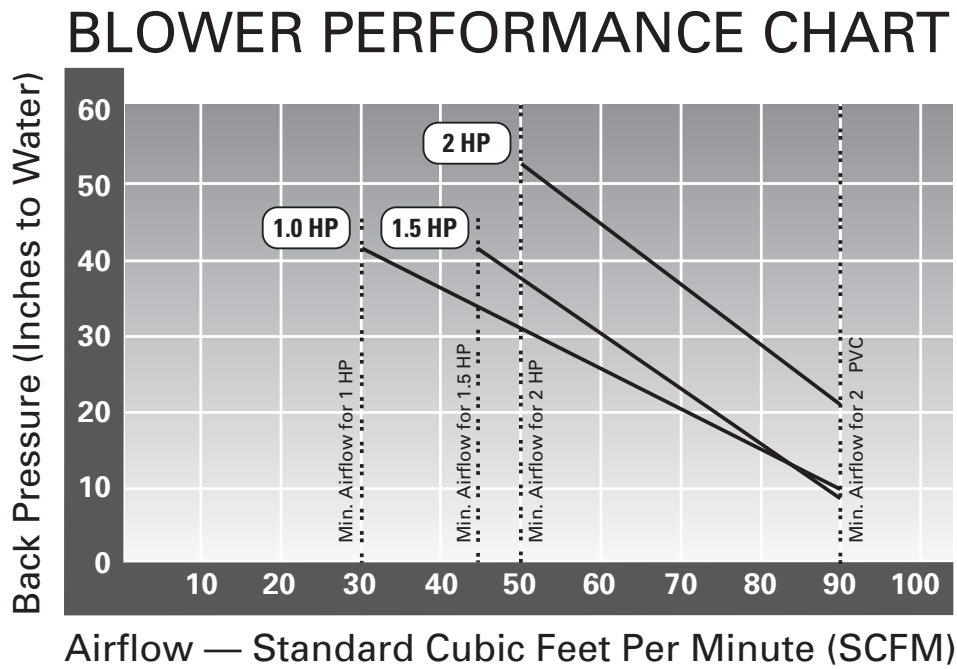
**Friction loss of water in feet of head per 100 foot length of pipe.**

**1. Calculate water depth in inches:**

- A. Actual water depth in injector = \_\_\_\_\_
  - B. Add ½" of water per 90° elbow = \_\_\_\_\_
  - C. Add ⅛" of water per 45° elbow = \_\_\_\_\_
  - D. Add 1" of water per 10 feet of 2" pipe = \_\_\_\_\_
  - E. Add 4" of water per ½" spring check valve = \_\_\_\_\_
- TOTAL INCHES OF WATER** = \_\_\_\_\_

**2. Find the airflow or SCFM provided by your blower:**

- A. On the **Blower Performance Chart**, find the number that corresponds to the **total inches of water** needed.
- B. Read across the chart until you **intersect the horsepower (HP)**, then go down for SCFM.
- C. **Take total SCFM and divide by 10** to get corresponding hole sizes.



**3. Calculate the number of holes by using the Air Hole Sizing Chart:**

Air Hole Sizing Chart	
Air Hole Size	Number of Holes Needed per 10 SCFM
⅛"	24
⅕"	15
⅜"	11
½"	6
⅝"	4
Jet	1



Hole Saw Sizes

**STORM JETS**

Jets - Mini Storm	
Flat Gasket	2 3/16"
Grommet Gasket	2 1/4"
Jets - Poly Storm	
Flat Gasket	2 5/8"
Grommet Gasket	2 11/16"
Jets - Power Storm	
Flat Gasket	3 3/4"
Grommet Gasket	3 7/8"
Jets - Adjustable Cluster Storm	1 1/2"

**JETS**

Jets - CAD and 180°	2 1/2"
Jets - Euro	1 1/16"
Jets - Fog	9/16"
Jets - Jumbo	5 3/4"
Jets - Jumbo Storm	5 3/4"
Jets - Master Massage	5 3/4"
Jets - Mega Storm with Flat Gasket	4 3/4"
Jets - Neck	1 3/4"
Jets - Old Faithful	4 3/4"
Jets - Ozone/Cluster	1"
Jets - Poly	2 5/8"
Jets - Power Swim	3 1/2"
Jets - Quad Flo and Dual Flo	3 1/2"
Jets - Self-Draining Bath	1 3/4"
Jets - Standard Mini	1 3/4"
Jets - Swim	3 1/8"
Jets - Versatile	3 1/2"

**SUCTIONS**

Suction - Lo-Pro and Hi-Flo	
Flat Gasket	2 3/8"
Grommet Gasket	2 1/2"
Suction - Super Hi-Flo	
Flat Gasket	3 1/4"
Grommet Gasket	3 3/8"
Suction - Ultra Hi-Flo	
Flat Gasket	2 3/8"
Grommet Gasket	2 1/2"
Suction - Ultra Flo	
Flat Gasket	3 1/4"
Grommet Gasket	3 3/8"

**AIR COMPONENTS**

Air Bleed	1 5/16"
Air Button	1 1/2"
Air Control - Lo-Pro	1 5/8"
Air Control - 1/2"	1 5/16"
Air Control - 1/2" Top Access	3/4"
Air Injector - Button	3/8"
Air Injector - Lo-Pro	3/4"
Air Injector - Multi-Body	5/8"
Air Injector - Ozone	5/8"
Air Injector - Top Flow	1 3/16"

**VALVES**

Valves - Diverter - 1" Mini	2 1/16"
Valves - Diverter - 2" Top Access	3 1/4"
Valves - Spa Drain and Fill	1 5/8"
Valves - Turn On / Off	1 1/4"

**LIGHTS**

Light - 1/2"	3/8"
Light - 1"	5/8"
Light - 2 1/8"	1 5/8"
Light - 3"	2 5/8"
Light - 5" Jumbo	3 3/4"

**SKIMMERS / FILTERS**

Skim Filter - Bayonet	6 7/8"
Grommet Gasket	7"
Skim Filter - Dyna-Flo	6 7/8"
Grommet Gasket	7"
Skimmers - Strip	
Flat Gasket	2 3/8"
Grommet Gasket	2 1/2"
Filters - In-Line	6 7/8"
Grommet Gasket	7"
Filters - Top Load	6 7/8"
Grommet Gasket	7"
Teleweir Skim Filters	6.88"

**SPECIALTY ITEMS**

Aroma Therapy Canister	1 5/8"
Auto Vent	4"
Cup Holder	3 3/4"
Fittings - Thru Wall	1 5/16"
Master Massage	5 3/4"
Niche Body	8 3/4"
Power Massage	3 1/2"
Return Fitting	2 5/16"
Thermosensor	1"
Thermowell - Mini	1 3/16"
Waterway Cascade	(2) x 7/8"



**To determine the GPM and PSI needed for jets desired:**

- 1. Write in the number of jets needed and jet type.**
- 2. Write in jet orifice size.**
- 3. Use the Jet Flow Chart & Performance Curve (on page 259) to determine GPM and PSI.**

**Jet Worksheet**

	Number of Jets	Jet Type	Jet Orifice Size	GPM	PSI
Example	10	Poly Storm Jets	5/16"	100 GPM (refer to Jet Flow Chart)	14 PSI

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Total Number of Jets	Total Jet Orifices	Total GPM	PSI <i>(not cumulative)</i>
-------------------------	--------------------	-----------	--------------------------------

**Total GPM is water volume needed to make jets work at desired PSI.  
 This is your **TARGET FLOW** and **TARGET PRESSURE**.  
 Take this number to Hydraulic Worksheet (next page) and use in Line 2.  
 This is the total GPM needed at a desired **PRESSURE**.**



**1. Determine required turnover rate for spa in gallons per minute (GPM).**

$$\frac{\text{Total Gallons}}{\text{Desired Turnover Rate (30 min. spa)}} = \text{GPM}$$

**2. Determine GPM and PSI needed for maximum jet performance (use Jet Performance Flow Curves from page 114).**

$$\frac{\text{Target Flow (GPM)}}{\text{Target Pressure (PSI)}}$$

**3. A. Figure resistance head of system:**

From Friction Flow Chart on page 258 and Friction Loss in Fittings on page 259, convert fittings and pipe lengths into feet of head.

EXAMPLE:

A. (4) 2" 90° elbows = 4 x 8.6 = 34.4 feet of 2" pipe

B. 50 feet of 2" pipe = 50 feet

A + B: 34.4 feet + 50 feet = 84.4 feet

Looking at the Friction Flow Chart, 2" pipe at 10 feet per second gives us 100 GPM at 14.4 feet of head. This is figured in 100 foot length of pipe. We multiply .844 times 14.4 = 12.15 feet of head. Or to convert to PSI x .433 = 5.26 PSI loss.

$$A \frac{\text{Quantity}}{\text{Quantity}} \times \frac{\text{Fitting Type (Friction Loss)}}{\text{Fitting Type (Friction Loss)}} = \frac{\text{Straight Length of Pipe}}{\text{Straight Length of Pipe}}$$

$$B \frac{\text{Quantity}}{\text{Quantity}} \times \frac{\text{Pipe}}{\text{Pipe}} = \frac{\text{Straight Length of Pipe}}{\text{Straight Length of Pipe}}$$

$$\frac{A}{A} + \frac{B}{B} = \frac{\text{Total Pipe Length}}{\text{Total Pipe Length}}$$

$$\frac{\text{Pipe Length}}{\text{Pipe Length}} \times \frac{\text{Head of Loss for 100 ft. Length}}{\text{Head of Loss for 100 ft. Length}} = \frac{\text{Feet of Head}}{\text{Feet of Head}}$$

**B. Figure Actual Head Loss of Components: (Refer to Head Loss Chart on Page 259)**

EXAMPLE:

1) One 1 1/2" main drain at 50 GPM has 2 feet of head.

2) One 1 1/2" skimmer 50 GPM has 4 feet of head.

Total head loss of components is 6 feet of head.

Quantity	GPM	Head Loss
_____	_____	_____
_____	_____	_____

Total Head Loss of Components: \_\_\_\_\_

**C. Add Head Loss from B and C for Total Resistance Head:**

EXAMPLE:

12.15 feet of head (from system resistance) + 6 feet of head (from component head loss) = 18.15 feet of head

$$\frac{\text{Resistance of Head Fittings, etc.}}{\text{Resistance of Head Fittings, etc.}} + \frac{\text{Component Head Loss}}{\text{Component Head Loss}} = \frac{\text{TDH}}{\text{TDH}}$$

**D. Total of B and C is TDH (total dynamic head) of system. Convert total head into PSI by multiplying by .433:**

EXAMPLE:

18.15 feet of head x .433 = 7.86 PSI

(This is the amount of pressure lost in the system)

$$\frac{\text{TDH}}{\text{TDH}} \times \frac{.433}{.433} = \frac{\text{PSI}}{\text{PSI}}$$

**E. Add Target PSI from Jet Worksheet (or Line #2) to Total Pressure Loss (PSI) Line D to find Total Pressure Required and Total Dynamic Head of System:**

EXAMPLE:

14 PSI (Required for jets) + 7.86 PSI (Required for system) = 21.86 PSI

$$\frac{\text{Jets PSI Required}}{\text{Jets PSI Required}} + \frac{\text{System PSI Required}}{\text{System PSI Required}} = \frac{\text{Total PSI Required}}{\text{Total PSI Required}}$$

**F. Match appropriate pump by looking at pump curves.**

EXAMPLE:

At 22 PSI (or 50 feet of head) at 100 GPM, you can use The Executive 1 HP Pump or a 2 HP Hi-Flo Side Discharge Pump



# Technical Information / Friction Flow Chart

## Friction loss of water in feet of head per 100 foot length of pipe.

U.S. Gal. per Min.	3/4 PIPE			1 PIPE			1 1/4 PIPE			1 1/2 PIPE			2 PIPE			2 1/2 PIPE			3 PIPE			
	Vel. Ft. per Sec.	Loss in Feet	Loss in PSI	Vel. Ft. per Sec.	Loss in Feet	Loss in PSI	Vel. Ft. per Sec.	Loss in Feet	Loss in PSI	Vel. Ft. per Sec.	Loss in Feet	Loss in PSI	Vel. Ft. per Sec.	Loss in Feet	Loss in PSI	Vel. Ft. per Sec.	Loss in Feet	Loss in PSI	Vel. Ft. per Sec.	Loss in Feet	Loss in PSI	
1	.60	.25	.11	.37	.07	.03	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2	1.20	.90	.39	.74	.28	.12	.43	.07	.03	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
3	1.80	1.92	.83	1.11	.60	.26	.64	.16	.07	.47	.07	.03	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
4	2.41	3.28	1.42	1.48	1.02	.44	.86	.25	.11	.63	.12	.05	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
5	3.01	5.8	2.51	1.86	1.52	.65	1.07	.39	.17	.79	.18	.08	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
6	3.61	7.0	3.0	2.33	2.15	.93	1.29	.55	.24	.95	.25	.11	.57	.07	.03	.....	.....	.....	.....	.....	.....	.....
8	4.81	11.8	5.1	2.97	3.6	1.56	1.72	.97	.42	1.25	.46	.2	.76	.14	.06	.54	.05	.02	.....	.....	.....	.....
10	6.02	17.9	7.75	3.71	5.5	2.4	2.15	1.46	.63	1.58	.69	.3	.96	.21	.09	.67	.09	.04	.....	.....	.....	.....
15	9.02	37.8	16.37	5.57	11.7	5.07	3.22	3.07	1.33	2.36	1.45	.63	1.43	.44	.19	1.01	.18	.08	.65	.07	.03	.....
20	.....	.....	.....	7.42	19.9	8.62	4.29	4.2	1.82	3.15	2.47	1.07	1.91	.74	.32	1.34	.30	.13	.....	.....	.....	.....
25	.....	.....	.....	9.28	30.0	13.0	5.36	7.9	3.42	3.94	3.8	1.6	2.39	1.11	.05	1.67	.46	.2	1.08	.16	.07	.....
30	.....	.....	.....	11.14	42.0	18.19	6.43	11.1	4.8	4.73	5.2	2.3	2.87	1.55	.67	2.01	.65	.28	1.30	.23	.1	.....
35	.....	.....	.....	.....	.....	.....	7.51	14.7	6.37	5.52	7.0	3.03	3.35	2.06	.89	2.35	.88	.38	1.52	.30	.13	.....
40	.....	.....	.....	.....	.....	.....	8.58	18.9	8.2	6.30	8.9	3.9	3.82	2.63	1.14	2.64	1.11	.48	1.73	.39	.17	.....
45	.....	.....	.....	.....	.....	.....	9.65	23.5	10.18	7.09	11.1	4.8	4.30	3.28	1.4	3.01	1.39	.6	1.95	.48	.21	.....
50	.....	.....	.....	.....	.....	.....	10.72	28.5	12.3	7.88	13.5	5.8	4.78	4.0	1.7	3.35	1.69	.73	2.17	.58	.25	.....
60	.....	.....	.....	.....	.....	.....	.....	.....	.....	9.46	18.9	8.18	5.74	5.6	2.4	4.02	2.36	1.02	2.60	.81	.35	.....
70	.....	.....	.....	.....	.....	.....	.....	.....	.....	11.03	25.1	10.9	6.69	7.4	3.2	4.69	3.14	1.36	3.04	1.09	.47	.....
80	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	7.65	9.5	4.1	5.35	4.0	1.73	3.47	1.39	.6	.....
90	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	8.60	11.8	5.1	6.03	5.0	2.2	3.91	1.73	.75	.....
100	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	9.56	14.4	6.3	6.70	6.1	2.64	4.34	2.10	1.9	.....
120	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	11.95	21.8	9.4	8.38	9.2	4.0	5.42	3.19	1.38	.....
150	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	10.05	12.8	5.5	6.51	4.5	1.95	.....
175	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	7.59	5.9	2.55	.....
200	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	8.68	7.9	3.4	.....
225	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	9.76	9.4	4.07	.....
250	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	10.85	11.5	4.99	.....
275	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
300	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
325	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

AWG Wire Size												
Amps	14		12		10		8		6		4	
	115 Volts	230 Volts	115 Volts	230 Volts	115 Volts	230 Volts	115 Volts	230 Volts	115 Volts	230 Volts	115 Volts	230 Volts
2	595	1190	946	1891	1479							
3	397	794	630	1261	986							
4	298	595	470	946	740	1479	1161		1808			
5	238	476	378	756	592	1184	926	1858	1447			
6	198	397	315	630	493	986	774	1548	1206	2411	1842	
7	170	340	270	540	423	845	663	1327	1033	2067	1579	
8	149	293	236	473	370	740	581	1161	904	1808	1381	2763
9	132	265	210	420	329	658	516	1032	804	1607	1228	2456
10	119	238	189	376	296	592	464	929	723	1447	1105	2210
12	99	198	158	315	247	493	387	774	603	1206	921	1842
14			135	270	211	423	332	663	517	1033	789	1579
16			118	236	185	370	290	581	452	904	691	1381
18					164	329	258	516	402	804	614	1228
20					148	296	232	464	362	723	553	1105
22					134	269	211	422		658		1005
24					123	247	194	387		603		921
26								357		556		850
28								332		517		789
30								310		482		737
35								265		413		632
40										362		553
45										321		491
50										239		442



**Friction Loss in Fittings**

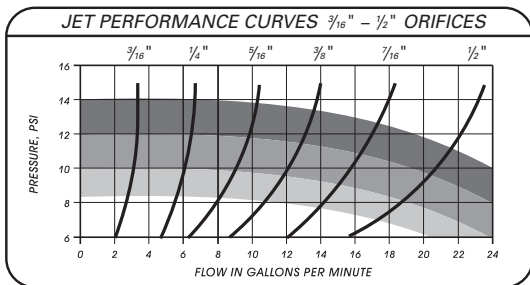
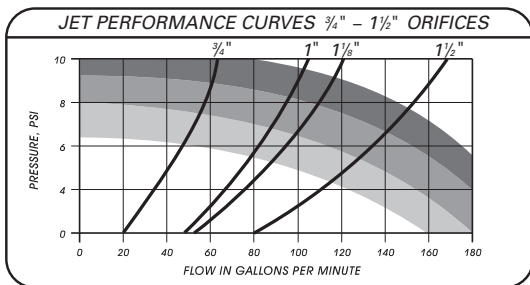
SIZE FITTING	½"	¾"	1"	1¼"	1½"	2"	2½"	3"	4"
Gate Valve (Full Open)	0.6	0.7	0.9	1.2	1.3	1.6	1.7	2.0	2.7
Elbow - 90°	3.6	4.5	5.3	6.7	7.5	8.6	9.3	11.1	13.1
Elbow - 45°	0.7	0.9	1.4	1.8	2.2	2.8	3.2	4.1	5.6
Tee (Straight Thru)	1.8	2.5	3.3	4.7	5.7	7.8	9.3	12.1	17.1
Tee (Thru Side)	4.3	5.4	6.7	8.8	10.0	12.1	13.0	17.1	21.2
Swing Check Valve	8.1	8.9	11.2	13.1	15.2	19.1	22.0	27.1	38.2

**Head Loss Charts**

Component	GPM	Head Loss (ft.)	Component	GPM	Head Loss (ft.)	Cartridge Filters	GPM (.75)	Head Loss (ft.)
Main Drain 1½" Outlet	20	0.5	Skimmer 1½" Outlet	20	1.0	25 sq. ft.	18.75	1.1
Main Drain 1½" Outlet	30	1.0	Skimmer 1½" Outlet	30	2.0	35 sq. ft.	26.25	2.0
Main Drain 1½" Outlet	40	1.5	Skimmer 1½" Outlet	40	3.0	50 sq. ft.	37.50	4.3
Main Drain 1½" Outlet	50	2.0	Skimmer 1½" Outlet	50	4.0	70 sq. ft.	52.50	7.5
Main Drain 1½" Outlet	60	2.5	Skimmer 1½" Outlet	60	5.5	75 sq. ft.	56.25	8.0
						100 sq. ft.	75.00	17.5
Main Drain 2" Outlet	40	1.0	Skimmer 2" Outlet	20	0.5			
Main Drain 2" Outlet	50	1.5	Skimmer 2" Outlet	30	1.0			
Main Drain 2" Outlet	60	2.0	Skimmer 2" Outlet	40	2.0			
Main Drain 2" Outlet	70	3.0	Skimmer 2" Outlet	50	3.0			
Main Drain 2" Outlet	80	4.0	Skimmer 2" Outlet	60	4.0			
			Skimmer 2" Outlet	70	5.0			
Heater	--	7.0 avg.	Skimmer 2" Outlet	80	6.0			

**Jet Flow Data**

Jet orifices sized from ¾" to 1½" work better at a lower PSI. Use legend to size properly.



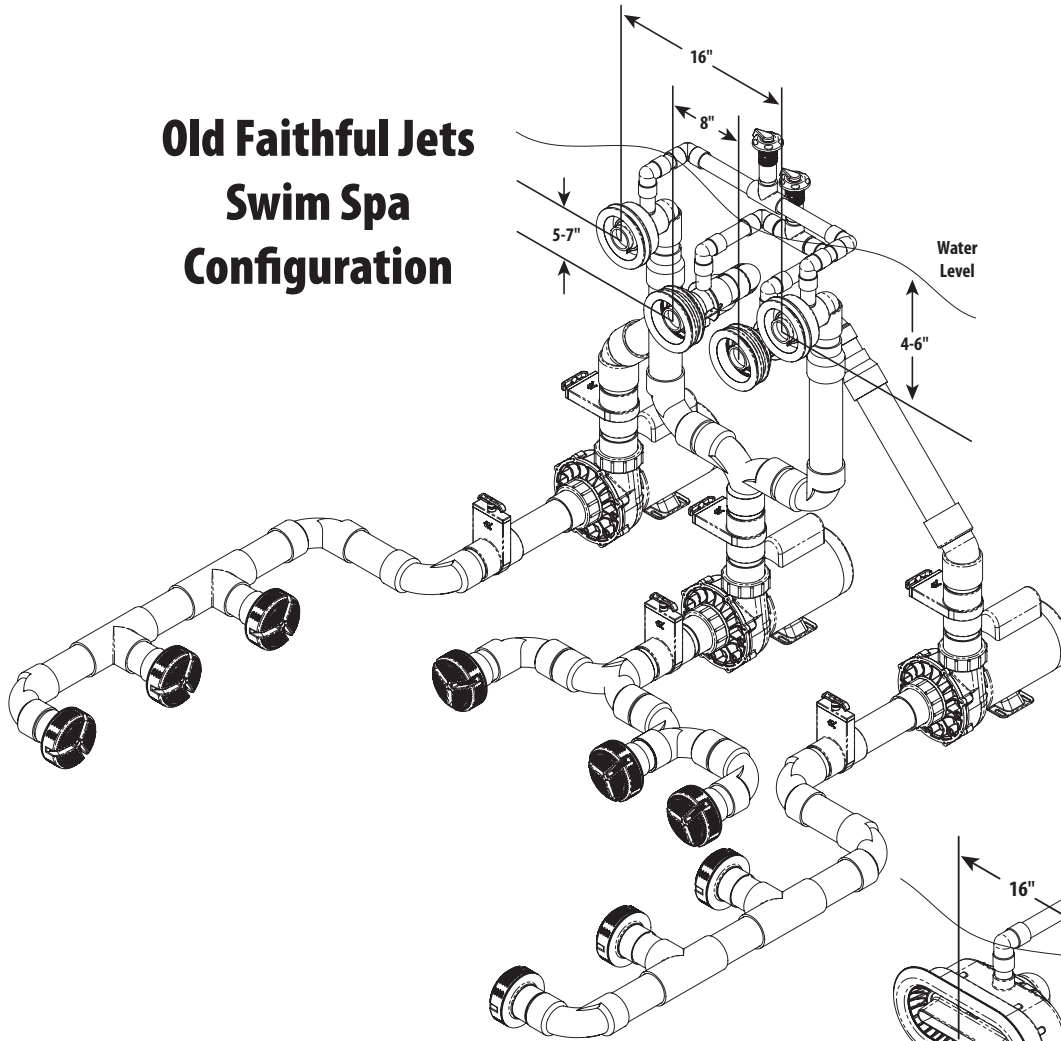
**LEGEND:**  
 ■ WEAK  
 ■ MODERATE  
 ■ STRONG

**JET FLOW CHART**

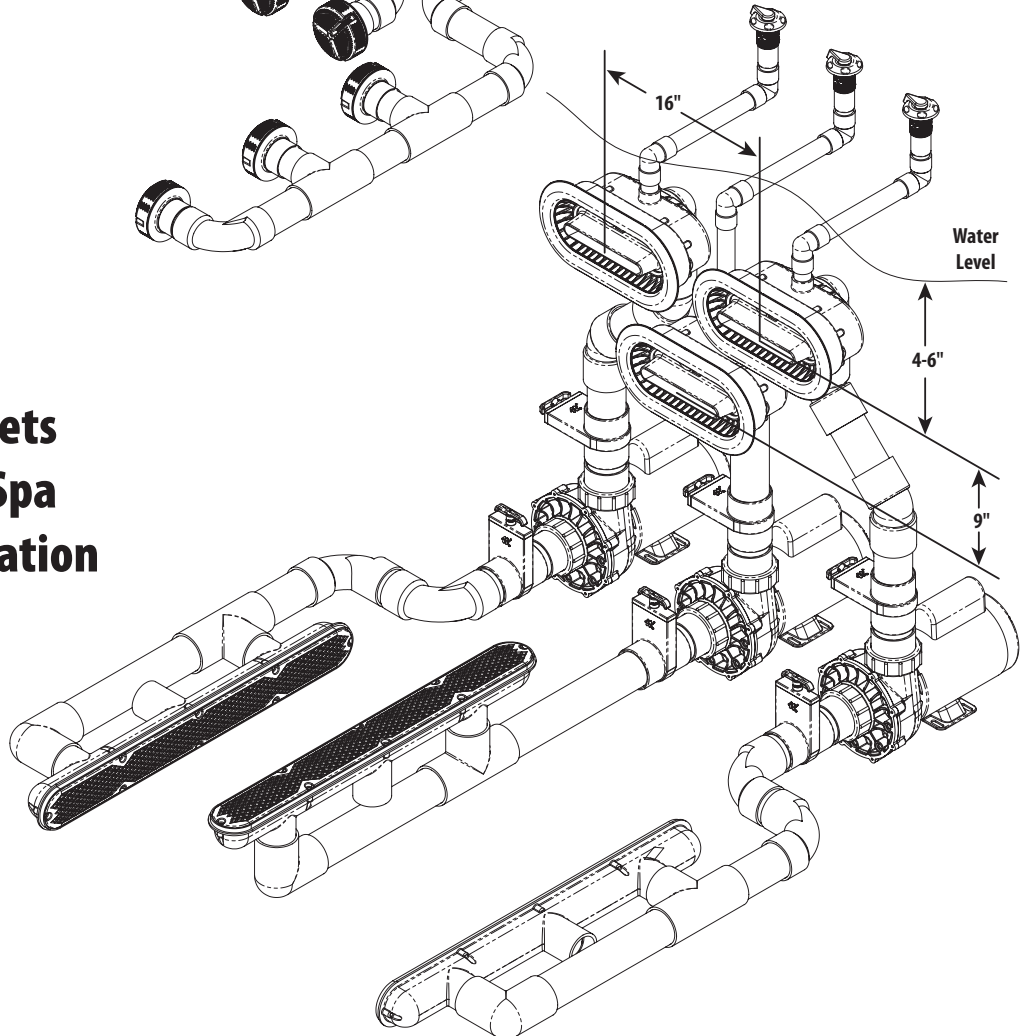
NOZZLE ORIFICE SIZE	JETS			GPM
	10 PSI	15 PSI	20 PSI	
3/16"	3	4	5	GPM
1/4"	6	7	8	GPM
5/16"	9	10	12	GPM
3/8"	13	16	18	GPM
7/16"	17	19	22	GPM
1/2"	24	29	33	GPM
3/4"	63	65	75	GPM
1"	95	116	134	GPM
1 1/8"	120	147	170	GPM
1 1/2"	213	260	301	GPM



### Old Faithful Jets Swim Spa Configuration



### River Jets Swim Spa Configuration





# Fax Cover

To: **Waterway Customer Service**  
Toll Free Fax: **888.772.5387 (888.spa jets)**

From:

Name: \_\_\_\_\_

Company: \_\_\_\_\_

Address: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_

**Builder**     **Mfr./OEM**     **Sub Assembly**     **Dealer**     **Service Firm**

**Swimming Pool**     **Distributor**     **Spa**     **Whirlpool Bath**

Quantity	Part No.	Description	Price Each	Price Total