Pump Sizing Information

HOW TO SELECT YOUR PUMP

1. **Before you size the pump, you need to know:**

1.1 **The Pump Speed**
This depends on what kind of drive you put on the pump; 3500, 1750 or 1150 RPM for 60 Hz motors and 3000, 1500 or 1000 RPM for 50 Hz motors. Variable speed curves are provided for diesel, belt drive and hydraulic motors.

1.2 **Total Head Required**
The total head (TH) required is the summation of vertical elevation (He) and friction head (Hf) plus the head required at the end of the piping. TH=He + Hf + head required at of the end of piping. Subtract the suction head when the source of supply is above the pump.
To calculate Friction Head loss SEE PAGE 23.

1.3 **Flow Rate**
The flow requirement in GPM or cubic meters per hour.

1.4 The **specific gravity** of the fluid or the weight of the fluid to be pumped such as the mud weight in ppg.

2. **After obtaining the above information.**

2.1 Find the required flow rate on the bottom or top scale and draw a straight line up or down.

2.2 Find the total head at the left or right hand scale and draw a straight line to the right or left.

2.3 Locate the intersection of the above two lines and pick the nearest impeller size. Impellers are available in 1/4" increments. Also a set of horsepower lines gives you the horsepower requirement for pumping water (It is best to choose a motor size larger than the minimum required). If you pump fluid other than water, you have to adjust the required HP (kW) by multiplying the specific gravity to the HP (kW) rating based on water.

3. **NPSH**
Net positive suction head is the useful pressure existing at the suction flange of the pump to push water into the impeller vanes. It is measured in feet (meters) of head. It is called NPSH Available (NPSHa). NPSH Required (NPSHr) is read from the pump curve at the designed pump impeller, RPM, and flow rate. NPSH on the curve is the lowest NPSH that will prevent the formation of vapor bubbles which cause cavitation.
Most customers are not concerned about NPSH problems. However over 50% of all rigs do have NPSH problems. These problems are due in part to high mud temperatures and poor suction design. You should check your net positive suction head (NPSH).

NPSHa Equation - Flooded Suction Systems only:
$$NPSHa = Ha + Hst - Hvp - Hfs$$
NPSHa Equation - Suction Lift Systems only:
$$NPSHa = Ha - Hst - Hvp - Hfs$$
Where:
NPSHa = Net Positive Suction Head Available
NPSHr = Net Positive Suction Head Required
Ha = Absolute Barometric Pressure
Hst = Fluid Supply Level above (Flooded Suction) or below (Suction Lift) Pump Centerline (in feet)
Hvp = Vapor Pressure of the fluid pumped at maximum operating temperature at the pump (in feet)
Hfs = Suction Line Friction Losses (in feet)

The NPSHr as shown on the curves is the minimum NPSH required by the pumps. If the NPSHa is greater than the NPSHr the pump will perform. If the NPSHa is less than NPSHr then the pump will cavitate and some changes to the suction conditions are necessary. Possible solutions are reducing the flow rate, increasing the suction pipe size, selecting a larger pump or lowering the pump speed.

4. **Formulas**

4.1 To Convert Head in Feet to Pressure in Pounds per Square Inch:
$$\frac{\text{Feet of Head X Specific Gravity}}{2.31} = \text{PSIG}$$

4.2 To convert Pressure in Pounds per Square Inch (PSI) to Head in Feet:
$$\frac{\text{PSIG x 2.31}}{\text{Specific Gravity}} = \text{Feet of Head}$$

4.3 Specific Gravity of Mud $= \frac{\text{Mud Weight (lbs/gal)}}{8.34}$

4.4 HP required = Curve HP x specific gravity

5. **Pump Sizing Rules**

5.1 Volume leaving pump increases until the volume pumped causes Total Head losses equal to its impeller output head.

5.2 It will help in the selection of impeller size if the friction loss curve is plotted on the pump curve.

5.3 Pressure or Head in Feet (meters)
When the pump is running pressure will build up. Pressure developed by the centrifugal pump is always specified as Head in Feet liquid. The relation between PSI and head is shown in 4.1-4.2. When sizing centrifugal pumps it is crucial to work in feet of head rather then PSI. PSI varies with the fluid weight while feet of head is a constant.

5.4 Centrifugal Pump Rotation
Stand at the drive end to determine the pump rotation. A right had rotation pump turns clockwise looking from the motor end. All the pumps featured in this catalog are right hand rotation.

Conversion Factors:

To convert	into	multiply by
m^3/hr	GPM	4.4
m^3/min	GPM	264
liters/min	GPM	0.264
liters/sec	GPM	15.9
Barrels/day	GPM	0.02917
cubic feet	Gallons	7.481
kg/cm^2	PSI	14.223
M^3	Gallons	264
meters	Feet	3.28
Bars	PSI	14.7
grams/cu. cm.	SpGr.	1

$$\text{BHP} = \frac{\text{GPM X Feet X Sp.Gr.}}{\text{3960 x Efficiency}}$$

$$\text{kW} = \frac{m^3\text{/hr x meters x Sp.Gr.}}{\text{367 x Efficiency}}$$

Efficiency from curve written as .XX

Affinity Laws

If there is a known operating point and a different operating point is required, the following algebraic formulas can be used to accurately predict what changes should be made to alter the flow or head and what the resulting horsepower requirements will be. A pump's performance can be altered by changing the speed or by changing the impeller diameter. **Note that while the speed formulas are very reliable, the impeller diameter formulas are accurate only for small variations in diameter.**

Speed Formulas or Impeller Diameter Formulas (Valid for small variations in dia. only, max 1")

Flow:

$$\frac{GPM1}{GPM2} = \frac{RPM1}{RPM2} \quad \text{or} \quad \frac{GPM1}{GPM2} = \frac{Dia1}{Dia2}$$

Total Differential Head:

$$\frac{TDH1}{TDH2} = \frac{RPM1^2}{RPM2^2} \quad \text{or} \quad \frac{TDH1}{TDH2} = \frac{Dia1^2}{Dia2^2}$$

Horsepower:

$$\frac{HP1}{HP2} = \frac{RPM1^3}{RPM2^3} \quad \text{or} \quad \frac{HP1}{HP2} = \frac{Dia1^3}{Dia2^3}$$

Example 1:

An 8x6x14 pump with an 11" impeller is operating 1000 GPM at 103 feet and requires 48 HP when pumping water. A contractor wants to be able to increase the discharge pressure to 115 feet. What will be the required impeller diameter, HP, and resulting flow rate?

Answers:

__________ **DIA**
__________ **GPM**
__________ **HP Required**

New Imp Dia:

$$\frac{115}{103} = \frac{X^2}{11^2} \quad \text{or } 1.0566 * 11 = X \text{ or } 11.62" = X$$

New Flow rate:

$$\frac{X}{1000} = \frac{11.62}{11} \quad \text{or } 1.056 * 1000 = X \text{ or } 1056 \text{ GPM} = X$$

HP Required:

$$\frac{X}{48} = \frac{11.62^3}{11^3} \quad \text{or } 48 * 1.177 = X \text{ or } 56 \text{ HP} = X$$

Example 2:

If a system exists and a particular operating point and the elevation are known, it is possible to calculate a new operating point by using the following friction loss formulas. Assume a system exists that has 20 feet of elevation and the pump is transferring water 500 GPM and the pressure gauge reads 50 PSI at the pump discharge. What pressure head is required to produce 1000 GPM?

First convert PSI to feet:
Pressure Head = 50 PSI * 2.31 / 1.0 Sp.Gr.
Pressure Head = 115 Feet

Subtract lift of 20 feet since this is a constant:
115 feet pressure head 20 feet elevation = 95 feet of system friction loss at 500 GPM

Use the following formula to determine the new pressure head required to produce 1000 GPM in this system:

$$\frac{\text{Friction loss 1}}{\text{Friction loss 2}} = \frac{GPM1^2}{GPM2^2} \quad \text{or} \quad \frac{X}{95} = \frac{1000^2}{500^2}$$

or $X = 95 (1000/500)^2 = 380$ Feet

Add back the lift:
380 + 20 = 400

It would therefore be necessary to size a pump for 1000 GPM at 400 feet to obtain the desired flow rate of 1000 GPM in the existing system.

SYSTEM HEAD REQUIREMENT WORK SHEET

CONDITIONS

Liquid Pumped ________________ Flow Rate (GPM) _________

Calculated Feet of Head __________ (line "6") Specific Gravity _________ Temperature _______ °F

1. Suction: Pipe Size ________ inches.

(1a) Vertical Distance (liquid surface to pump center line+/-). Positive number if above pump center line or negative number if below pump center line ____________ feet.

(1b) Total length of suction line ____________ feet.

(1c) Straight pipe equivalent of suction fittings:

Type	Qty.		Equiv. Ft. per Fitting (Ref. Table on page 25)		Total Equiv. Ft. of Straight Pipe
Elbow	_____	x	_______________	=	_____________
Tee Running	_____	x	_______________	=	_____________
Tee Branched	_____	x	_______________	=	_____________
Swing Check	_____	x	_______________	=	_____________
Globe Valve	_____	x	_______________	=	_____________
Butterfly Valve	_____	x	_______________	=	_____________
			(1c) Sum Total	=	_____________

(1d) Add (1b) and (1c) = ____________ equivalent feet of straight suction pipe.

(1e) Convert to friction loss head: $\frac{(1d)}{100}$ x Head Loss (Ref. Table on page 24) = ___feet of head (friction loss)

2. Discharge: Pipe Size ________ inches.

(2a) Vertical Distance (centerline of pump to highest point in discharge system +/-) ______ feet.

(2b) Total length of discharge line ___________ feet.

(2c) Straight pipe equivalent of discharge fittings:

Type	Qty.		Equiv. Ft. per Fitting (Ref. Table on page 25)		Total Equiv. Ft. of Straight Pipe
Elbow	_____	x	_______________	=	_____________
Tee Running	_____	x	_______________	=	_____________
Tee Branched	_____	x	_______________	=	_____________
Swing Check	_____	x	_______________	=	_____________
Globe Valve	_____	x	_______________	=	_____________
Butterfly Valve	_____	x	_______________	=	_____________
			(2c) Sum Total	=	_____________

(2d) Add (2b) and (2c) = ____________ equivalent feet of straight suction pipe.

(2e) Convert to friction loss head: $\frac{(2d)}{100}$ x Head Loss (Ref. Table on page 24) = ___feet of head (friction loss)

3. Pressure required at discharge point __________ $\frac{\text{psig x 2.31}}{\text{Sp.Gr.}}$ = _________ feet of head.

4 Total Friction Head (Hf) = (1e) + (2e) _________

5. Total Elevation Head (He) = (2a) - (1a) _________

6. Total Head Required at Pump Discharge = Hf + He + line "3" = ___________ feet of head required.[1]

[1] NOTE: NPSHa must also be considered. See previous pages for NPSHa calculation method.

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Friction of Water in Pipes C=100

GPM	V	F	V	F	V	F	V	F	V	F	V	F	GPM
	2" PIPE		3" PIPE		4" PIPE		5" PIPE		6" PIPE		8" PIPE		
30	3.06	3.69	1.36	0.53	0.77	0.13							30
40	4.08	6.40	1.81	0.91	1.02	0.22							40
50	5.11	9.90	2.27	1.38	1.28	0.34	0.82	0.11					50
60	6.13	13.40	2.72	1.92	1.53	0.48	0.98	0.16					60
70	7.15	17.04	3.18	2.56	1.79	0.63	1.14	0.21	0.79	0.09			70
80	8.17	22.50	3.63	3.28	2.04	0.81	1.31	0.27	0.91	0.11			80
90	9.19	28.00	4.08	4.08	2.30	1.01	1.47	0.34	1.02	0.14			90
100	10.21	35.80	4.54	4.96	2.55	1.22	1.63	0.41	1.14	0.17			100
125	12.76	50.90	5.68	7.50	3.19	1.85	2.04	0.62	1.42	0.26			125
150	15.32	76.00	6.81	10.50	3.83	2.59	2.47	0.87	1.70	0.36	0.96	0.09	150
175	17.86	92.50	7.95	14.00	4.47	3.44	2.86	1.16	1.99	0.48	1.12	0.12	175
200	20.40	129.00	9.08	17.90	5.10	4.41	3.27	1.49	2.27	0.61	1.28	0.15	200
225			10.20	22.30	5.74	5.48	3.68	1.85	2.55	0.76	1.44	0.19	225
250			11.30	27.10	6.38	6.67	4.08	2.25	2.84	0.93	1.60	0.23	250
275			12.50	32.30	7.02	7.96	4.50	2.68	3.12	1.11	1.76	0.27	275
300			13.60	37.90	7.65	9.34	4.90	3.13	3.41	1.30	1.91	0.32	300
350			15.90	50.40	8.93	12.40	5.72	4.20	3.97	1.73	2.23	0.43	350
400			18.20	64.60	10.20	15.90	6.54	5.38	4.54	2.21	2.55	0.55	400
450					11.50	19.80	7.36	6.68	5.10	2.75	2.87	0.68	450
500					12.80	24.10	8.18	8.12	5.68	3.34	3.19	0.82	500
550					14.00	28.70	8.99	9.69	6.24	3.99	3.51	0.98	550
600					15.30	33.70	9.81	11.40	6.81	4.68	3.82	1.15	600
650					16.60	39.10	10.60	13.20	7.38	5.43	4.15	1.34	650
700					17.90	44.90	11.40	15.10	7.94	6.23	4.47	1.53	700
750					18.90	51.30	12.30	17.20	8.51	7.08	4.78	1.74	750
800							13.10	19.40	9.08	7.98	5.10	1.97	800
900							14.70	24.10	10.20	9.92	5.74	2.44	900
1000							16.30	29.30	11.40	12.10	6.38	2.97	1000
1100							18.00	35.00	12.50	14.40	7.02	3.55	1100
1200							19.56	41.20	13.60	16.90	7.66	4.17	1200
1300							21.19	48.00	14.80	19.60	8.30	4.83	1300
1400							22.82	54.80	15.90	22.50	8.93	5.54	1400
1500							24.45	62.40	17.00	25.50	9.55	6.30	1500
1600									18.20	28.80	10.20	7.10	1600
1800									20.52	35.90	11.50	9.83	1800
2000									22.80	43.60	12.80	10.70	2000

V = Velocity feet per second
F = Friction head in feet
Loss of head in feet, due to friction, per 100 feet of ordinary pipe and velocity in feet per second.
Values taken from Williams and Hazen tables, based on coefficient C = 100. For new pipes multiply friction loss value by 0.70.

Values of C for various types of pipe are given below together with the corresponding multiplier which should apply to the tabulated values of the head loss, hf.

Values of C

TYPE OF PIPE	RANGE: High = best, smooth, well laid Low = poor or corroded	Average value for good, clean new pipe	Commonly used value for design purposes
Cement - asbestos	160-140	150	140
Fibre	-	150	140
Bitumastic-enamel-lined iron or steel centrifugally applied	160-130	148	140
Cement lined iron or steel centrifugally applied	-	150	140
Copper, brass, lead, tin or glass pipe and tubing	150-120	140	130
Wood-stave	140-110	120	110
Welded and seamless steel	150-80	140	100
Continuous-interior riveted steel (no projecting rivets or joints)	-	139	100
Wrought iron	150-80	130	100
Cast-iron	150-80	130	100
Tar-coated cast iron	145-80	130	100
Girth-riveted steel (projecting rivets in girth seams only)	-	130	100
Concrete	152-85	120	100
Full-riveted steel (projecting rivets in girth and horizontal seams)	-	115	100
Vitrified	-	110	100
Spiral-riveted steel (flow with lap)	-	110	100
Spiral-riveted steel (flow against lap)	-	100	90
Corrugated steel	-	60	60

Table Correction Multipliers										
Value of C…	130	120	110	100	90	80	70	80	70	60
Multiplier to correct tables	0.63	0.71	0.84	1.00	1.22	1.58	1.93	1.58	1.93	2.57

Friction Loss in Pipe Fittings in Terms of Equivalent Feet of Straight Pipe

Nominal Pipe Size	Actual Inside Diameter	Gate valve --- full open	90° elbow	Long radius 90° or 45° std. elbow	Std. tee --- thru flow	Std. tee --- branch flow	Close retun bend	Swing check valve --- full open	Angle valve --- full open	Globe valve --- full open	Butterfly valve
1-1/2	1.61	1.07	4.03	2.15	2.68	8.05	6.71	13.4	20.1	45.6	
2	2.067	1.38	5.17	2.76	3.45	10.3	8.61	17.2	25.8	58.6	7.75
2-1/2	2.469	1.65	6.17	3.29	4.12	12.3	10.3	20.6	30.9	70.0	9.26
3	3.068	2.04	7.67	4.09	5.11	15.3	12.8	25.5	38.4	86.9	11.5
4	4.026	2.68	10.1	5.37	6.71	20.1	16.8	33.6	50.3	114.0	15.1
5	5.047	3.36	12.6	6.73	8.41	25.2	21	42.1	63.1	143	18.9
6	6.065	4.04	15.2	8.09	10.1	30.3	25.3	50.5	75.8	172	22.7
8	7.981	5.32	20	10.6	13.3	39.9	33.3	58	99.8	226	29.9
10	10.02	6.68	25.1	13.4	16.7	50.1	41.8	65	125	284	29.2
12	11.938	7.96	29.8	15.9	19.9	59.7	49.7	72	149	338	34.8
14	13.124	8.75	32.8	17.5	21.8	65.6	54.7	90	164	372	38.3
16	15	10	37.5	20	25	75	62.5	101	188	425	31.3
18	16.876	16.9	42.2	22.5	28.1	84.4	70.3	120	210	478	35.2
20	18.814	12.5	47	25.1	31.4	94.1	78.4	132	235	533	39.2

Calculated from data in Crane Co. - Technical Paper 410

Properties of Water

Temperature °F	Temperature °C	Specific Gravity	Vapor Pressure of water, absolute (feet)
40	4.4	1.001	0.30
50	10	1.001	0.40
60	15.6	1.000	0.60
70	21.1	0.999	0.80
80	26.7	0.998	1.20
90	32.2	0.996	1.60
100	37.8	0.994	2.20
110	43.3	0.992	3.00
120	48.9	0.990	4.00
130	54.4	0.987	5.20
140	60	0.985	6.80
150	65.6	0.982	8.80
160	71.1	0.979	11.20
170	76.7	0.975	14.20
180	82.2	0.972	17.90

Theoretical Discharge of Nozzles in U.S. Gallons Per Minute

Head		Velocity of Discharge	Diameter of nozzle (inches)																			
psi	feet*	(ft/sec)	3/8	1/2	5/8	3/4	7/8	1	1-1/8	1-1/4	1-3/8	1-1/2	1-3/4	2	2-1/4	2-1/2	2-3/4	3	3-1/2	4
10	23.1	38.6	13.3	23.6	36.9	53.1	72.4	94.5	120	148	179	213	289	378	479	591	714	851	1158	1510
15	34.6	47.25	16.3	28.9	45.2	65.0	88.5	116.0	147	181	219	260	354	463	585	723	874	1041	1418	1850
20	46.2	54.55	18.8	33.4	52.2	75.1	102.0	134.0	169	209	253	301	409	535	676	835	1009	1203	1638	2135
25	57.7	61.00	21.0	37.3	58.3	84.0	114.0	149.0	189	234	283	336	458	598	756	934	1128	1345	1830	2385
30	69.3	66.85	23.0	40.9	63.9	92.0	125.0	164.0	207	256	309	368	501	655	828	1023	1236	1473	2005	2615
35	80.8	72.20	24.8	44.2	69.0	99.5	135.0	177.0	224	277	334	398	541	708	895	1106	1335	1591	2168	2825
40	92.4	77.20	26.6	47.3	73.8	106.0	145.0	188.0	239	296	357	425	578	756	957	1182	1428	1701	2315	3020
45	103.9	81.80	28.2	50.1	78.2	113.0	153.0	200.0	253	313	379	451	613	801	1015	1252	1512	1802	2455	3200
50	115.5	86.25	29.7	52.8	82.5	119.0	162.0	211.0	267	330	399	475	647	845	1070	1320	1595	1900	2590	3375
55	127.0	90.50	31.1	55.3	86.4	125.0	169.0	221.0	280	346	418	498	678	886	1121	1385	1671	1991	2710	3540
60	138.6	94.50	32.5	57.8	90.4	130.0	177.0	231.0	293	362	38	521	708	926	1172	1447	1748	2085	2835	3700
65	150.1	98.30	33.8	60.2	94.0	136.0	187.0	241.0	305	376	455	542	737	964	1220	1506	1819	2165	2950	3850
70	161.7	102.10	35.2	62.5	97.7	141.0	191.0	250.0	317	391	473	563	765	1001	1267	1565	1888	2250	3065	4000
75	173.2	105.70	36.4	64.7	101.0	146.0	198.0	259.0	327	404	489	582	792	1037	1310	1619	1955	2330	3170	4135
80	184.8	109.10	37.6	66.8	104.0	150.0	205.0	267.0	338	418	505	602	818	1070	1354	1672	2020	2405	3280	4270
85	196.3	112.50	38.8	68.9	108.0	155.0	211.0	276.0	349	431	521	620	844	1103	1395	1723	2080	2480	3375	4400
90	207.9	115.80	39.9	70.8	111.0	160.0	217.0	284.0	359	443	536	638	868	1136	1436	1773	2140	2550	3475	4530
95	219.4	119.00	41.0	72.8	114.0	164.0	223.0	292.0	369	456	551	656	892	1168	1476	1824	2200	2625	3570	4655
100	230.9	122.00	42.1	74.7	117.0	168.0	229.0	299.0	378	467	565	672	915	1196	1512	1870	2255	2690	3660	4775

The actual quantity discharged by a nozzle will be less than the above table. A well tapered smooth nozzle may be assumed to flow 97 to 99% of the values in the tables. Mud gun nozzles will flow approximately 85% of the above table and hopper nozzles will flow approximately 75% of the above table.

** Head in feet basis water at approximately 60°F*

Pump Performance Curves

UNDERSTANDING PUMP PERFORMANCE CURVES

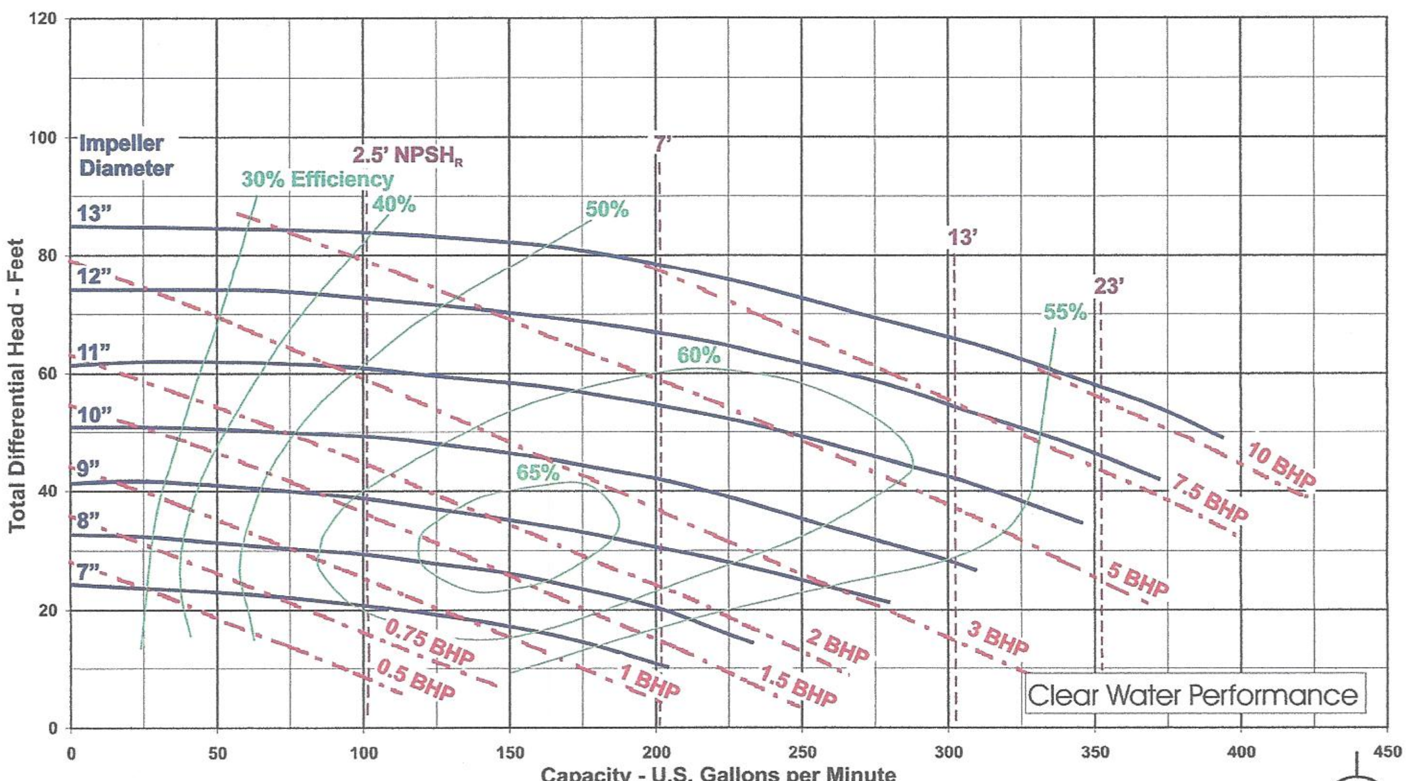
The head vs. flow curves on the following pages give you the performance of the Magnum, 2500 Supreme, Magnum Vertical, 2500 Vertical and Sandmaster pumps at various speeds and with various impeller sizes. The horsepower (HP) rating is based on pumping water with a specific gravity of 1.0. The flow is measured in US liquid gallons per minute (GPM). The total differential head is measured in feet. There are also a series of Efficiency and Net Positive Suction Head Required (NPSHr) lines showing the pump hydraulic efficiency and minimum NPSHr. The performance curves are plotted based on actual test results for each size of pumps running at various RPM and with various impeller sizes.

To determine the HP required for your system you will need to determine the Specific Gravity (Sp.Gr.) of the fluid being transferred and then multiply the Sp.Gr. by the HP shown on the curve. To determine Sp.Gr.:

$$\text{Specific Gravity} = \frac{\text{ppg of fluid}}{8.34}$$

Magnum I
3X2X13
Speed: 1150 RPM
Curve: 944

Open Impeller
Dia: 7" to 13"
Eye Area: 7.1 Sq. In.
Max Sphere: ½ In.



NATIONAL OILWELL VARCO

N.D.S. Drilling Supply
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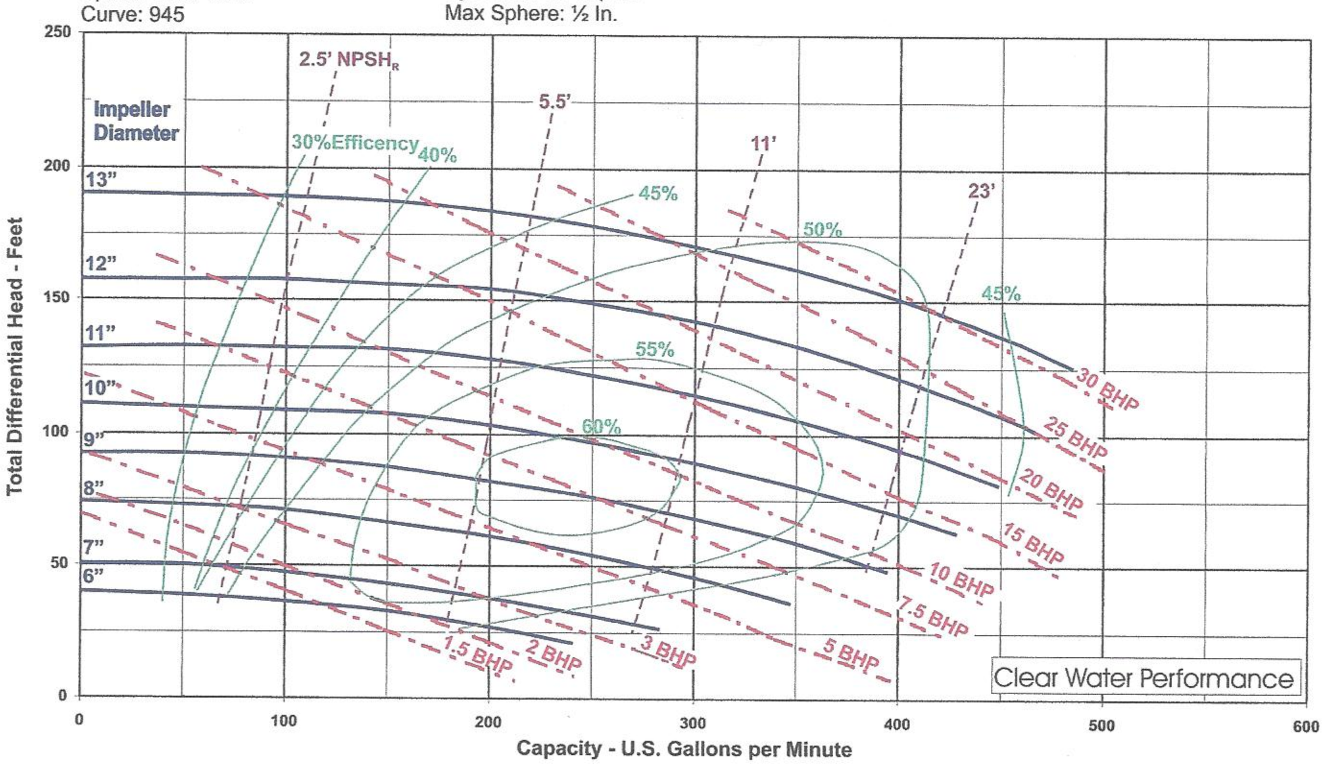
Elko, MN 55020
Phone # 800-637-1940
Fax # 952-461-3403

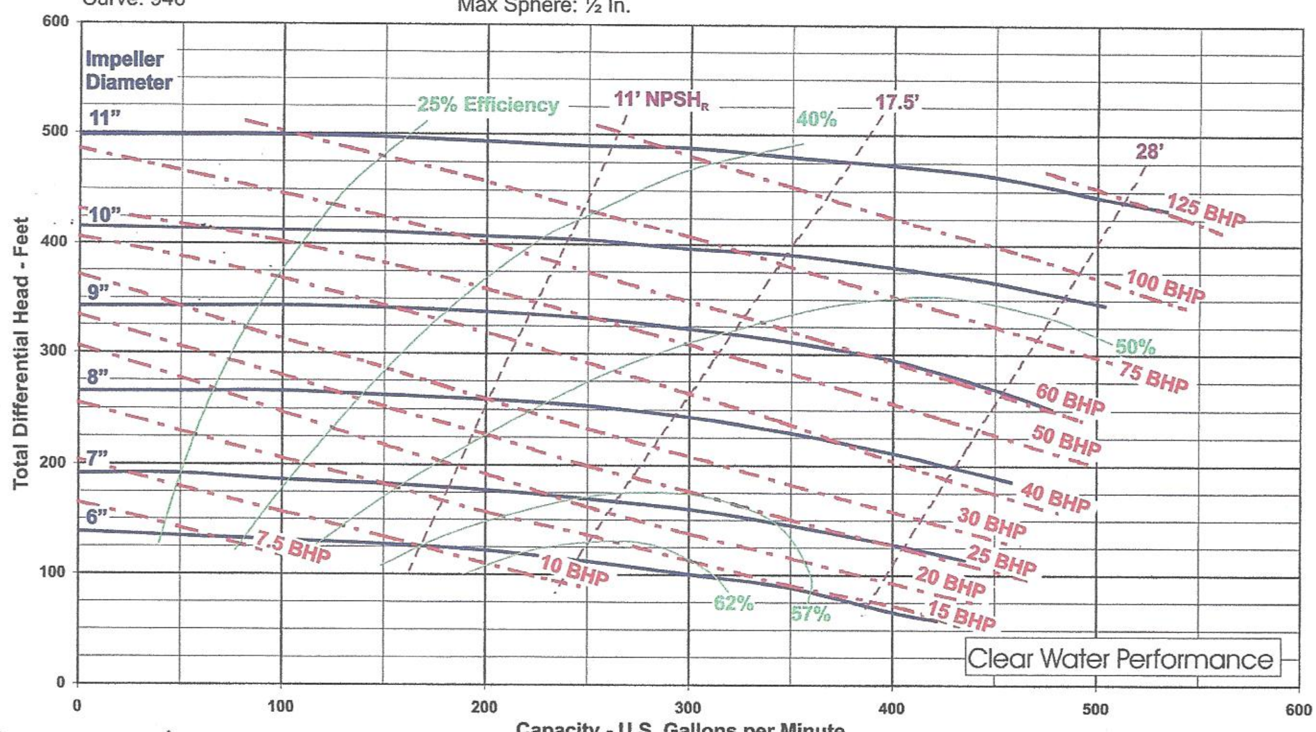
Magnum I
3X2X13
Speed: 1750 RPM
Curve: 945

Open Impeller
Dia: 6" to 13"
Eye Area: 7.1 Sq. In.
Max Sphere: ½ In.



Magnum I
3X2X13
Speed: 3500 RPM
Curve: 946

Open Impeller
Dia: 6" to 11"
Eye Area: 7.1 Sq. In.
Max Sphere: ½ In.



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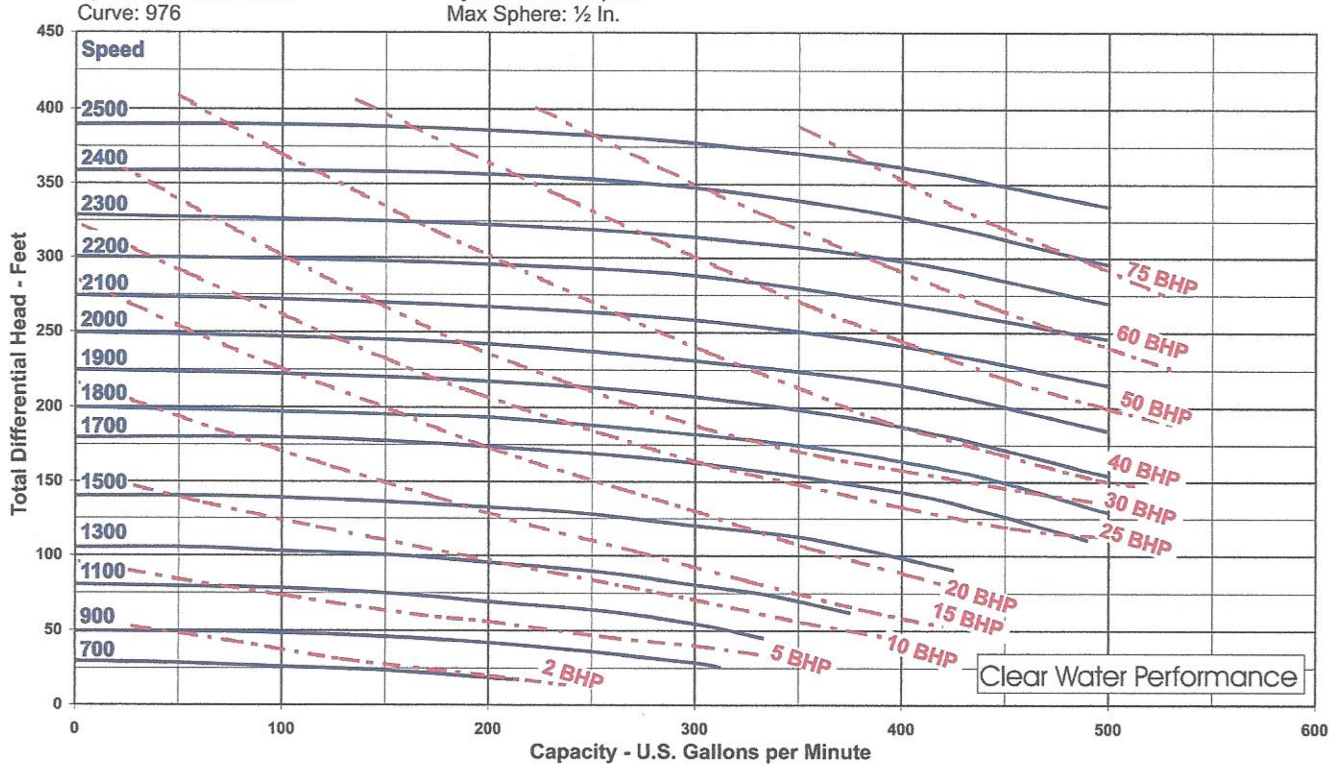
Phone # 800-637-1940
Fax # 952-461-3403

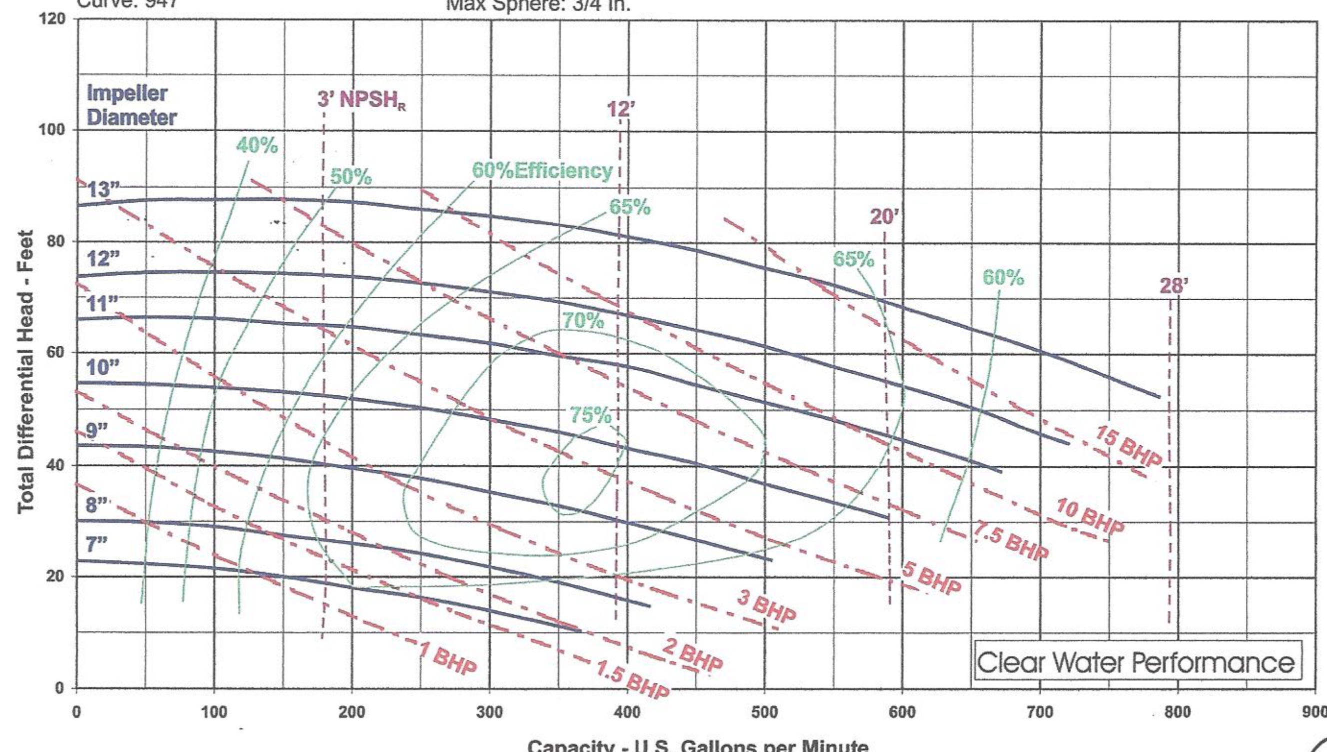
Magnum I
3X2X13
Speed: 700-2500 RPM
Curve: 976

Open Impeller
Dia: 13"
Eye Area: 7.1 Sq. In.
Max Sphere: ½ In.



Magnum I
4X3X13
Speed: 1150 RPM
Curve: 947

Open Impeller
Dia: 7" to 13"
Eye Area: 12.5 Sq. In.
Max Sphere: 3/4 In.



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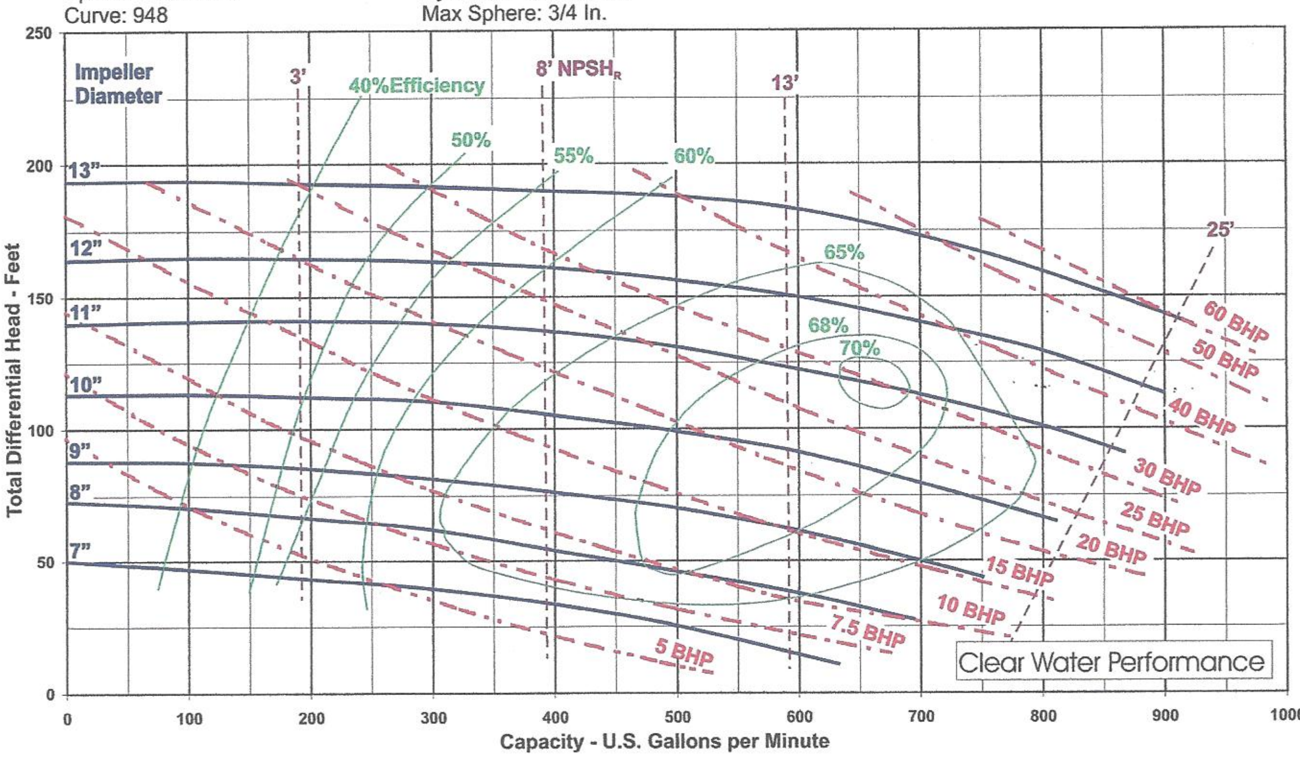
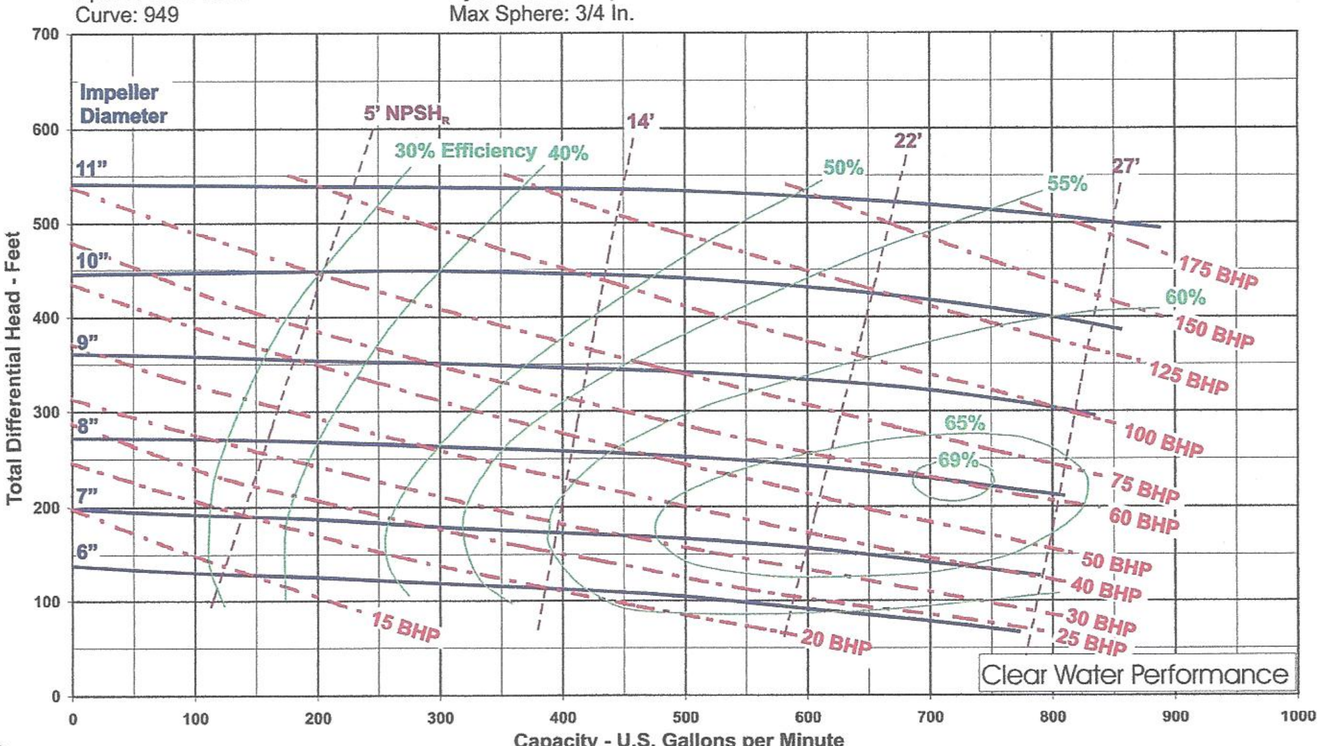
Magnum I
4X3X13
Speed: 1750 RPM
Curve: 948

Open Impeller
Dia: 7" to 13"
Eye Area: 12.5 Sq. In.
Max Sphere: 3/4 In.



Magnum I
4X3X13
Speed: 3500 RPM
Curve: 949

Open Impeller
Dia: 6" to 11"
Eye Area:12.5 Sq. In.
Max Sphere: 3/4 In.



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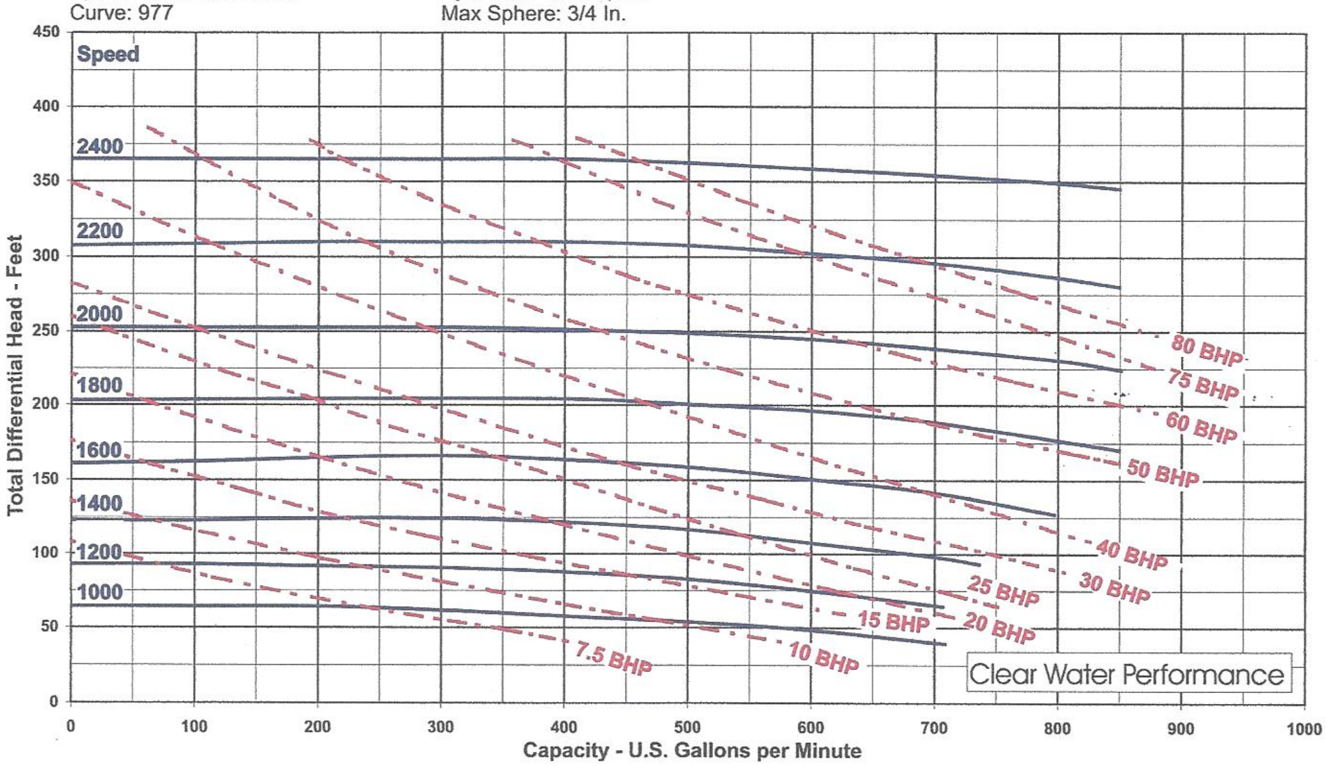
Fax # 952-461-3403

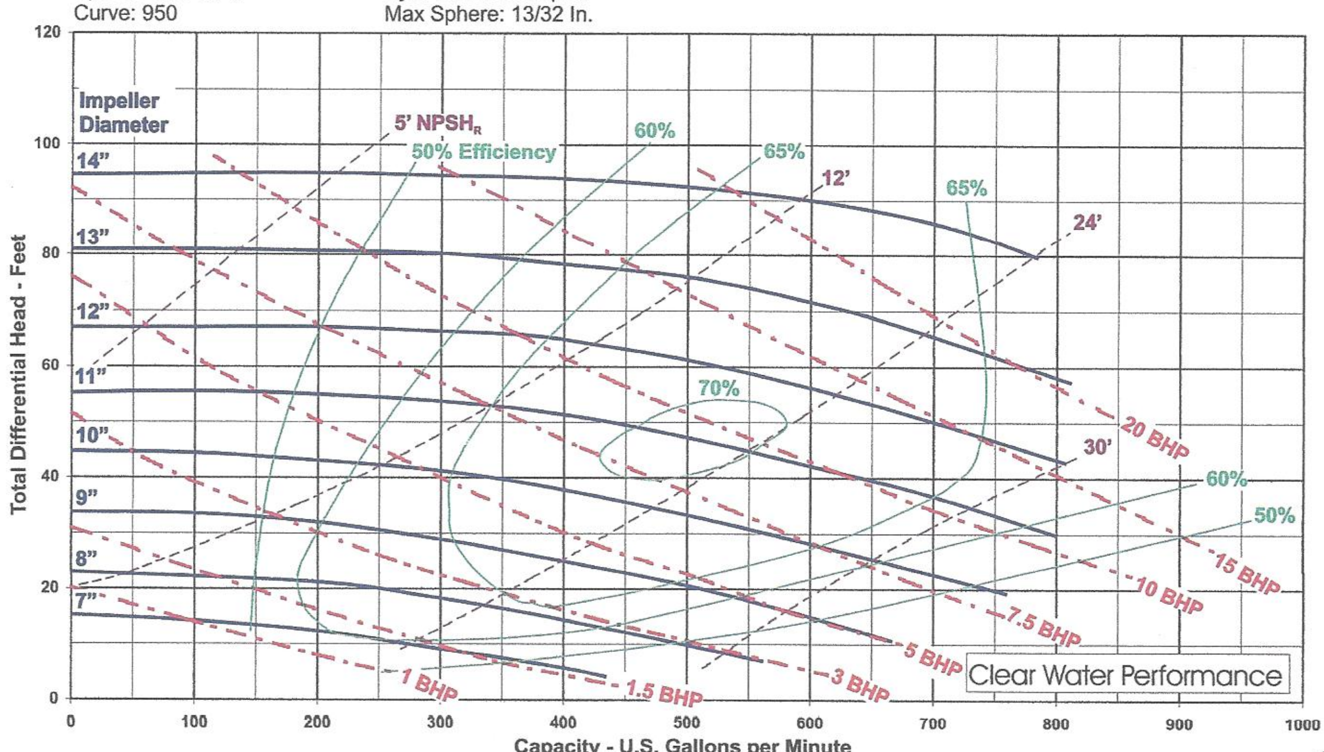
Magnum I
4X3X13
Speed: 1000-2400 RPM
Curve: 977

Open Impeller
Dia: 13"
Eye Area: 12.5 Sq. In.
Max Sphere: 3/4 In.



Magnum I
5X4X14
Speed: 1150 RPM
Curve: 950

Open Impeller
Dia: 7" to 14"
Eye Area: 19.6 Sq. In.
Max Sphere: 13/32 In.



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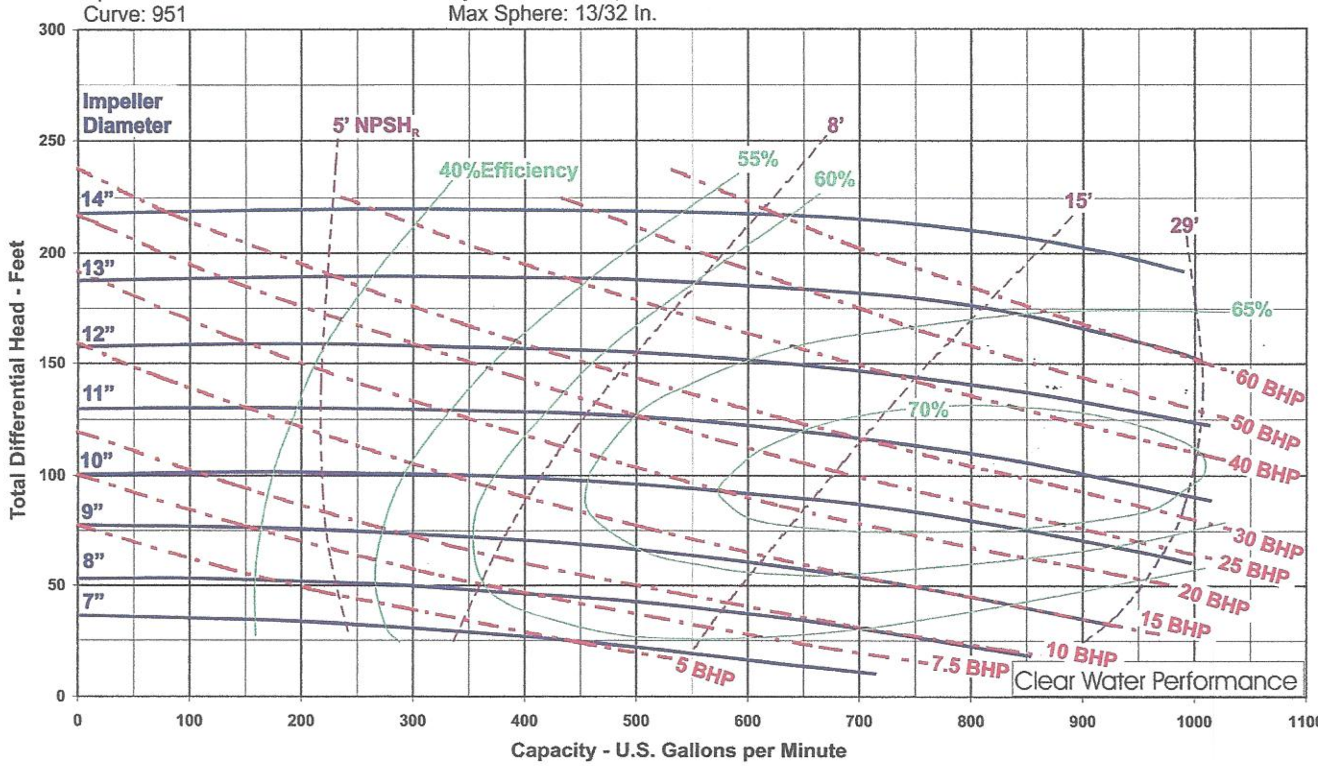
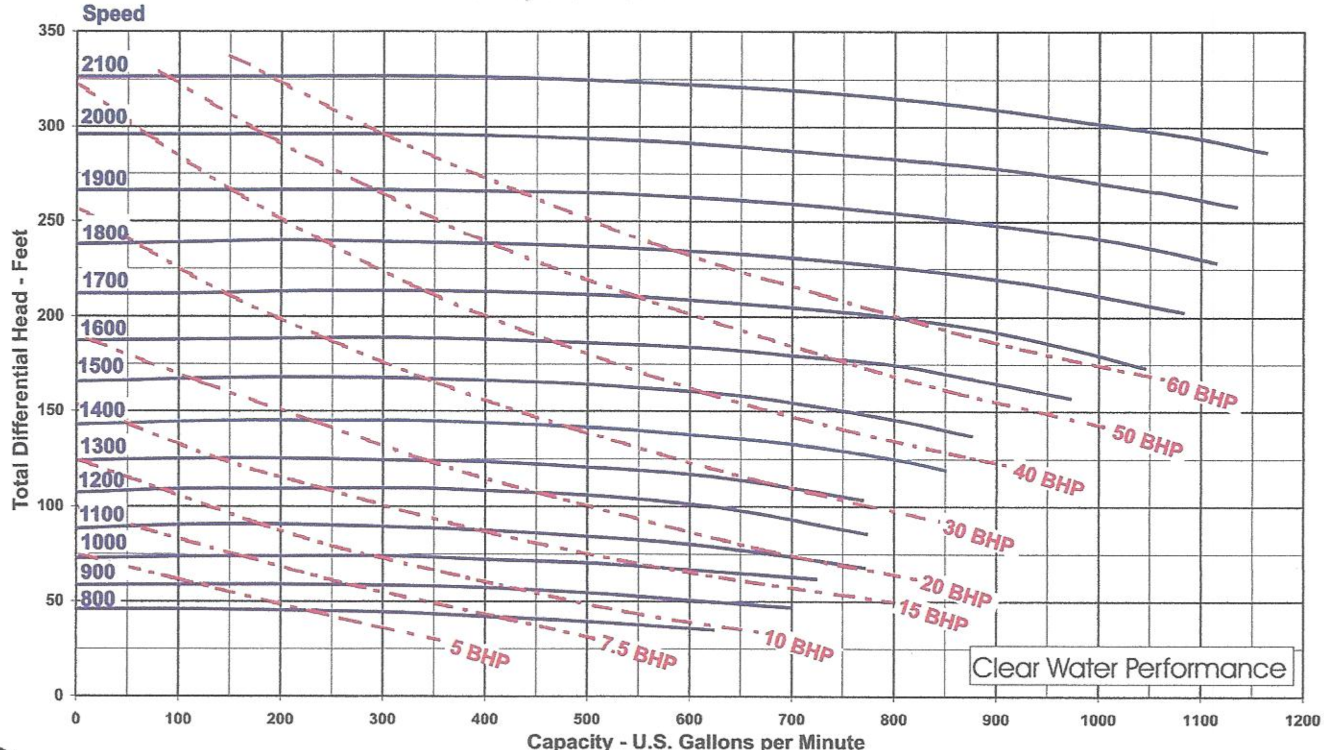
Magnum I
5X4X14
Speed: 1750 RPM
Curve: 951

Open Impeller
Dia: 7" to 14"
Eye Area: 19.6 Sq. In.
Max Sphere: 13/32 In.



Magnum I
5X4X14
Speed: 800-2100 RPM
Curve: 978

Open Impeller
Dia: 14"
Eye Area: 19.6 Sq. In.
Max Sphere: 13/32 In.



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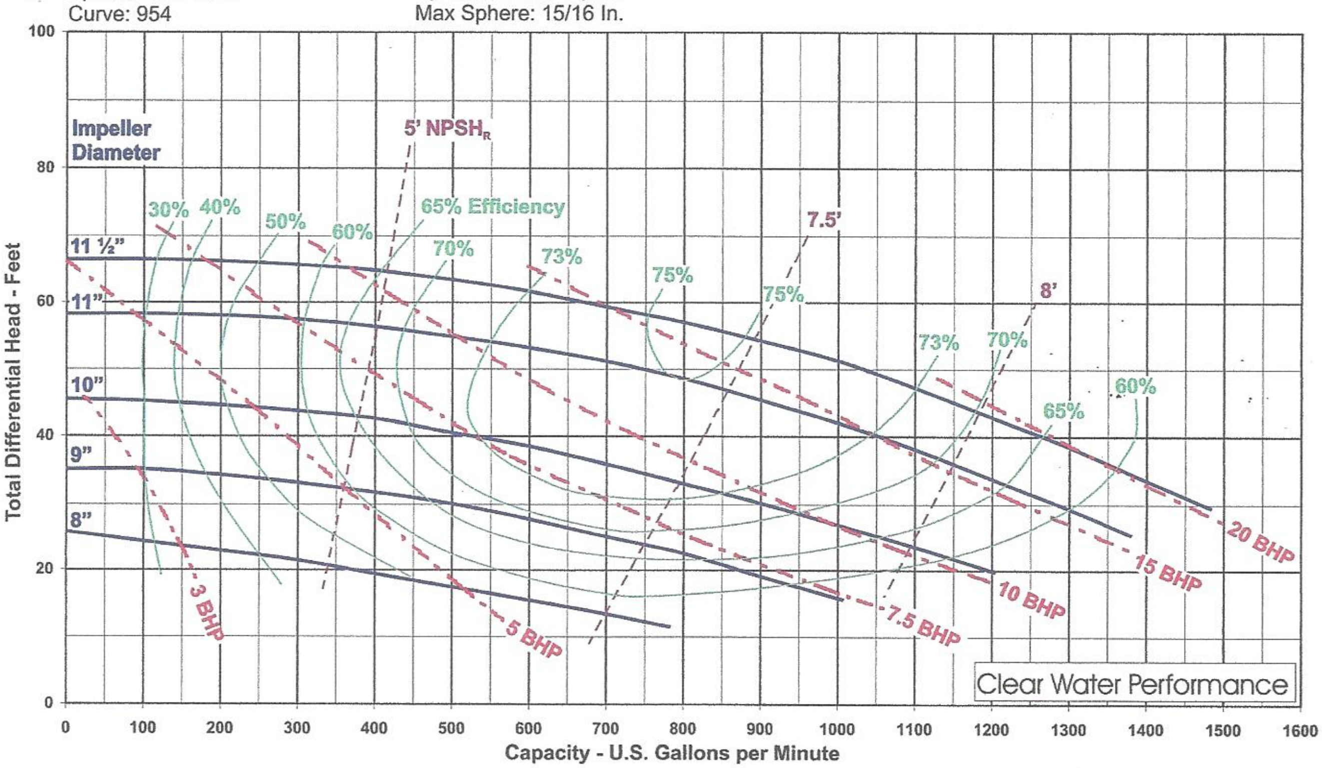
Fax # 952-461-3403

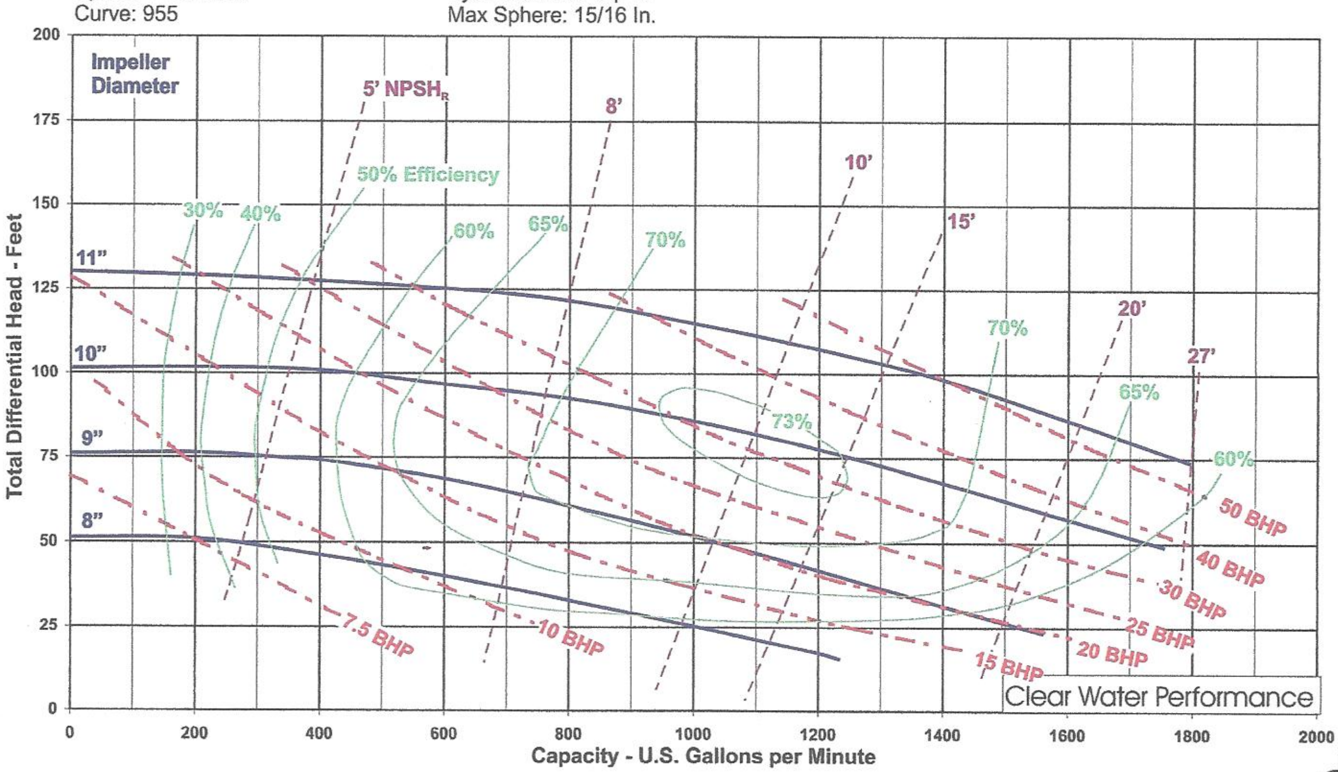
Magnum I
6X5X11
Speed: 1150 RPM
Curve: 954

Open Impeller
Dia: 8" to 11 ½"
Eye Area: 28.3 Sq. In.
Max Sphere: 15/16 In.



Magnum I
6X5X11
Speed: 1750 RPM
Curve: 955

Open Impeller
Dia: 8" to 11"
Eye Area: 28.3 Sq. In.
Max Sphere: 15/16 In.



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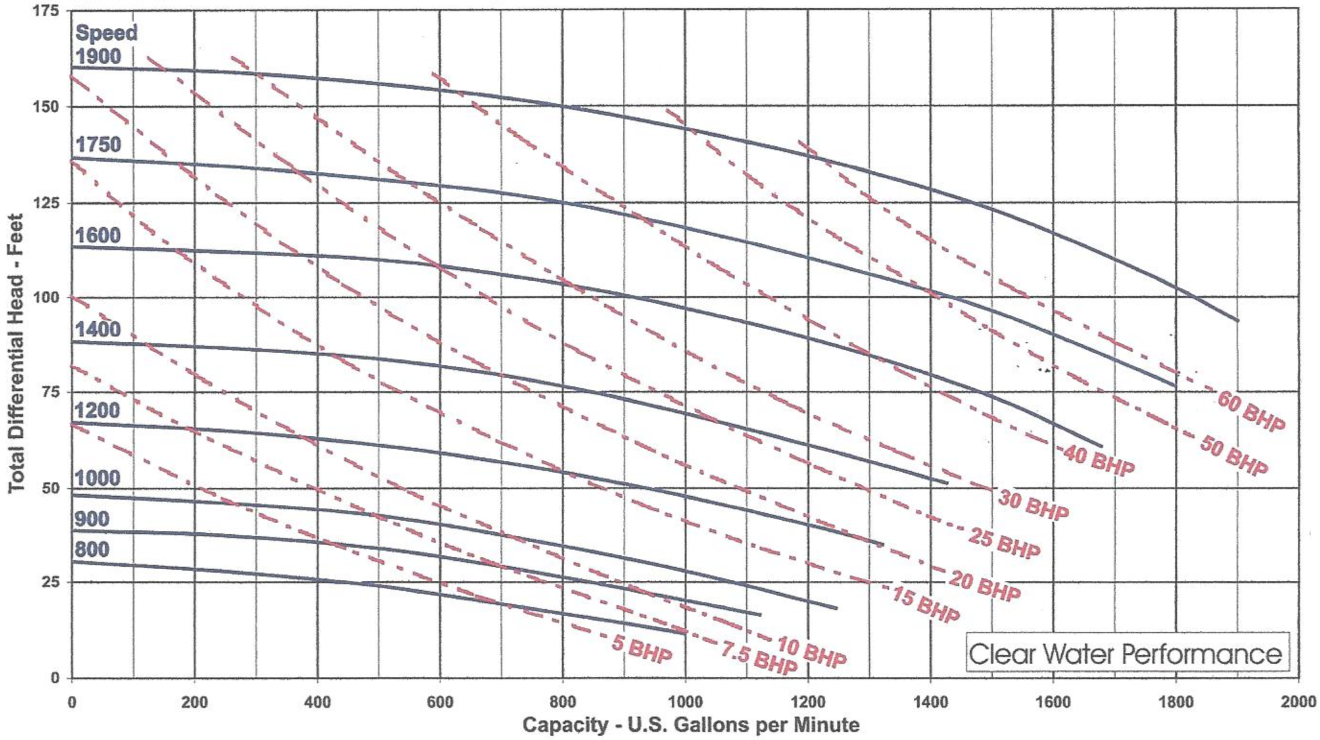
Fax # 952-461-3403

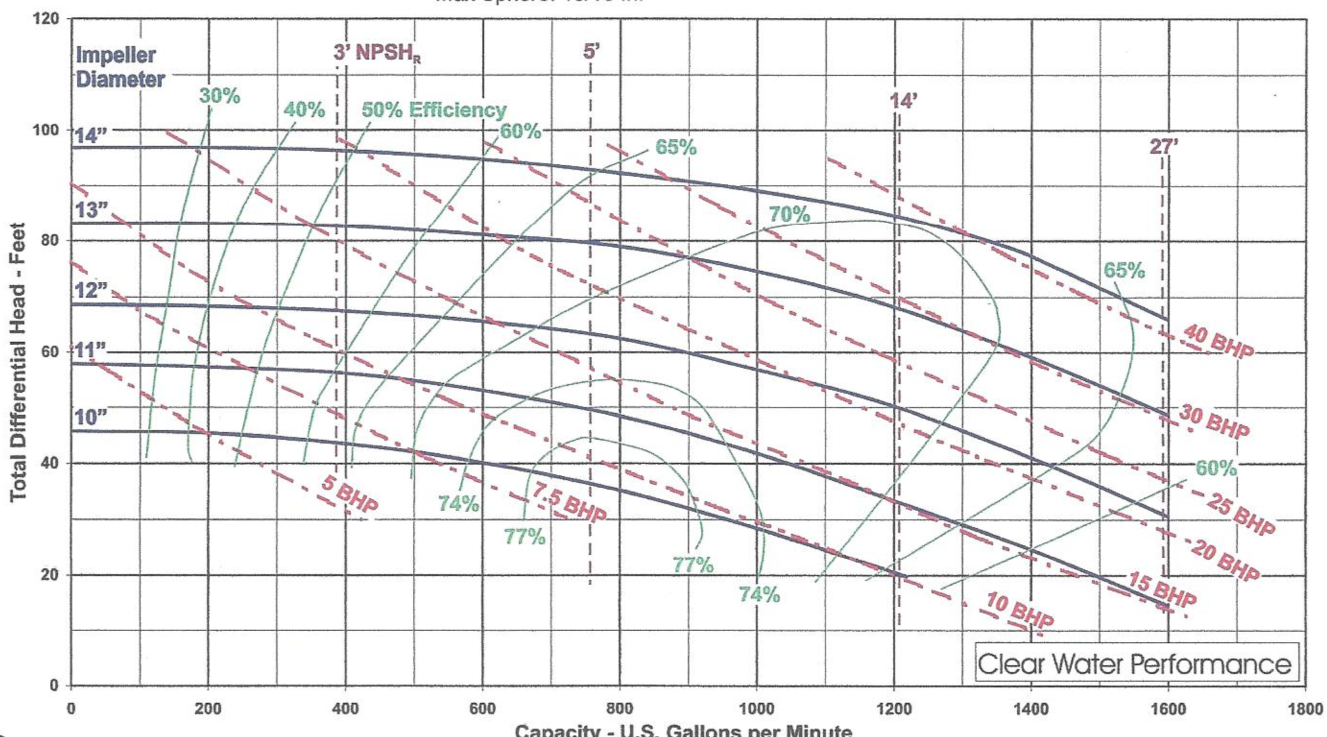
Magnum I
6X5X11
Speed: 800 - 1900 RPM
Curve: 981

Open Impeller
Dia: 11"
Eye Area: 28.3 Sq. In.
Max Sphere: 15/16 In.



Magnum I
6X5X14
Speed: 1150 RPM
Curve: 952

Open Impeller
Dia: 10" to 14"
Eye Area: 28.3 Sq. In.
Max Sphere: 15/16 In.



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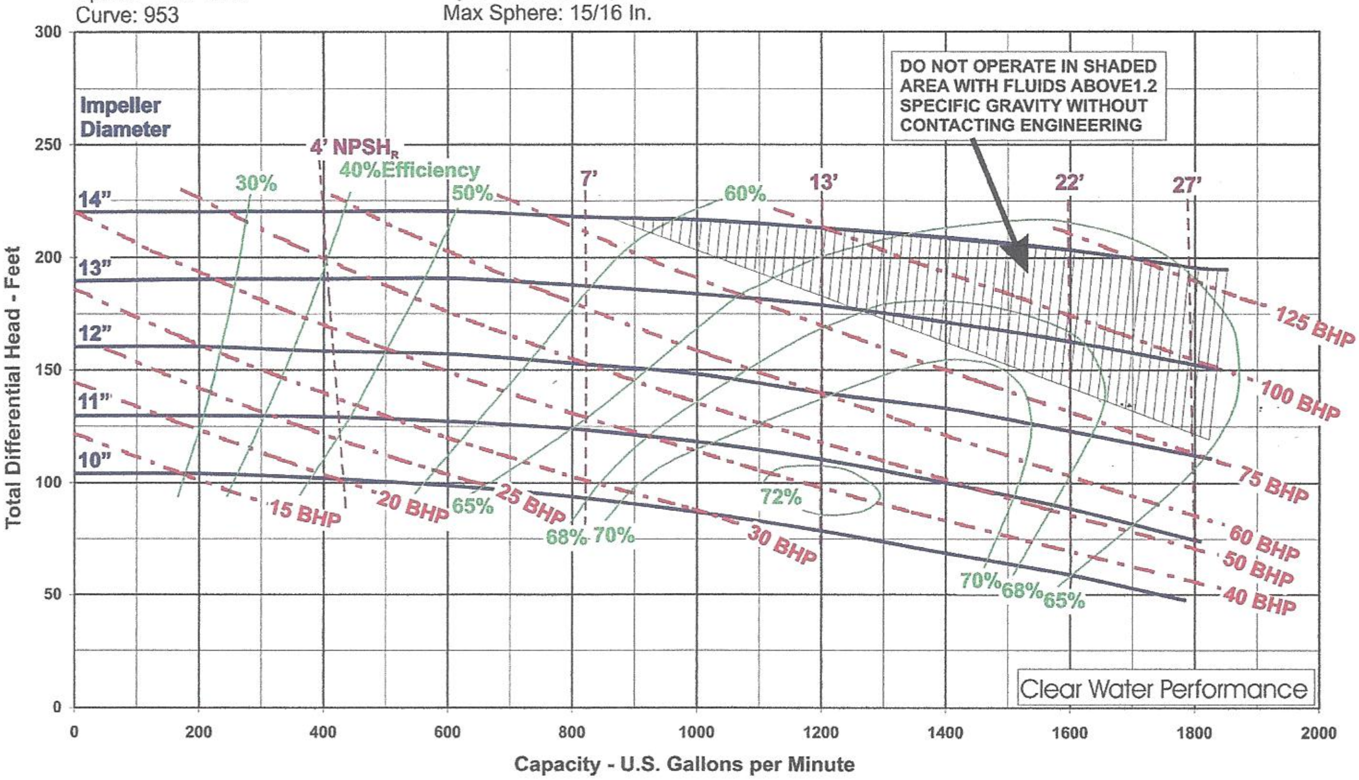
Fax # 952-461-3403

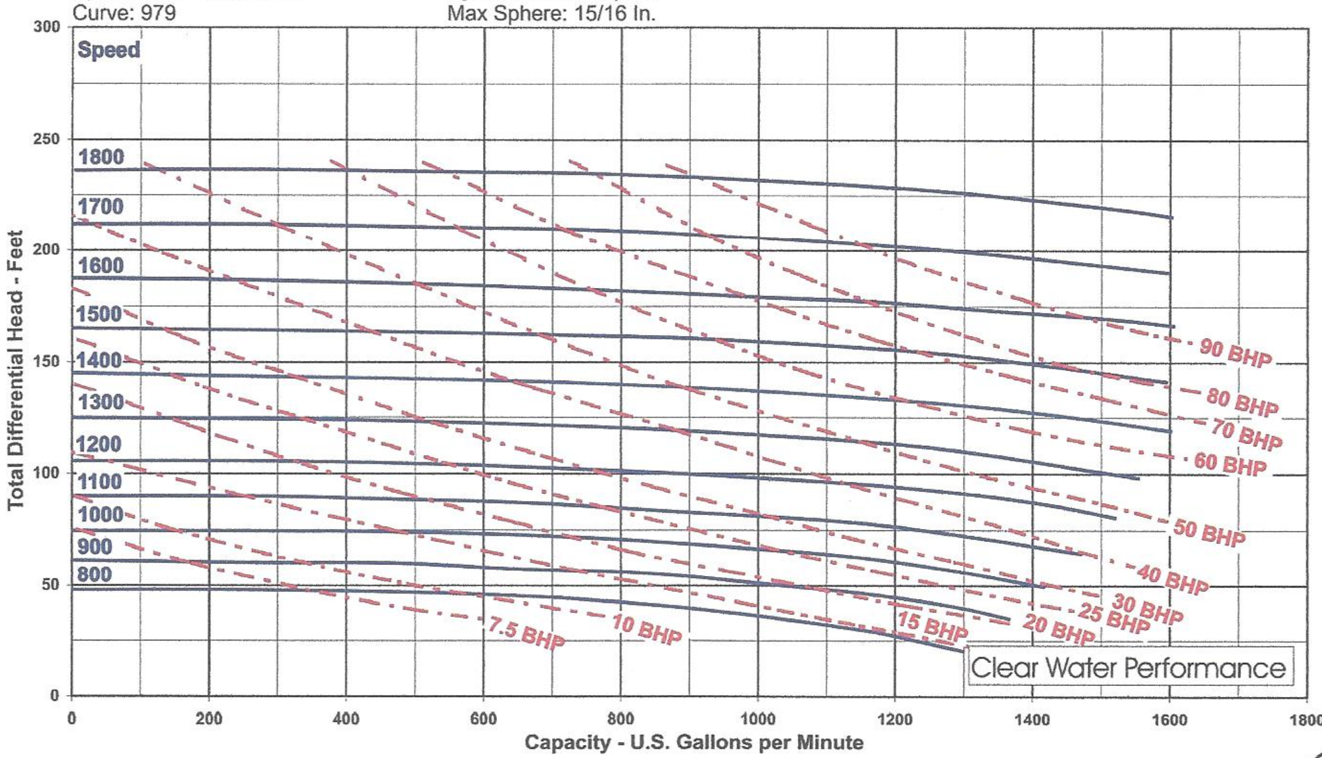
Magnum I
6X5X14
Speed: 1750 RPM
Curve: 953

Open Impeller
Dia: 10" to 14"
Eye Area: 28.3 Sq. In.
Max Sphere: 15/16 In.



Magnum I
6X5X14
Speed: 800 - 1800 RPM
Curve: 979

Open Impeller
Dia: 14"
Eye Area: 28.3 Sq. In.
Max Sphere: 15/16 In.



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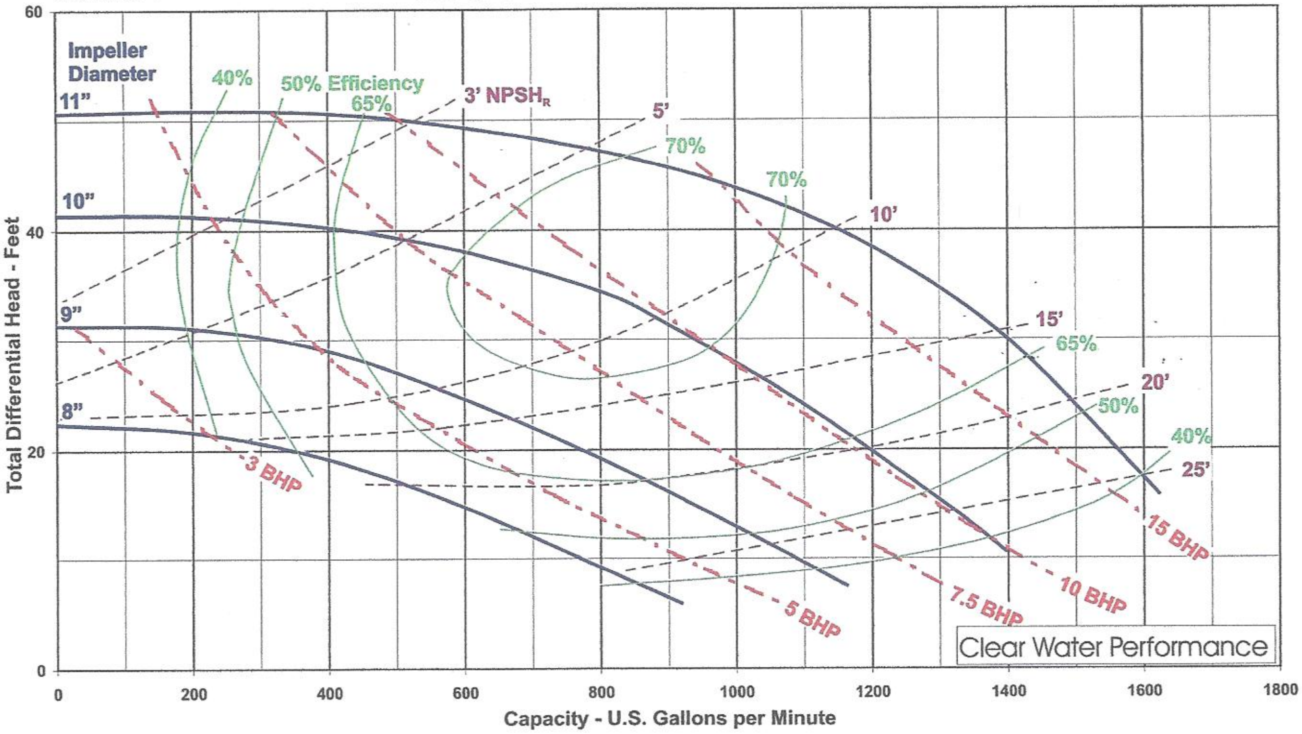
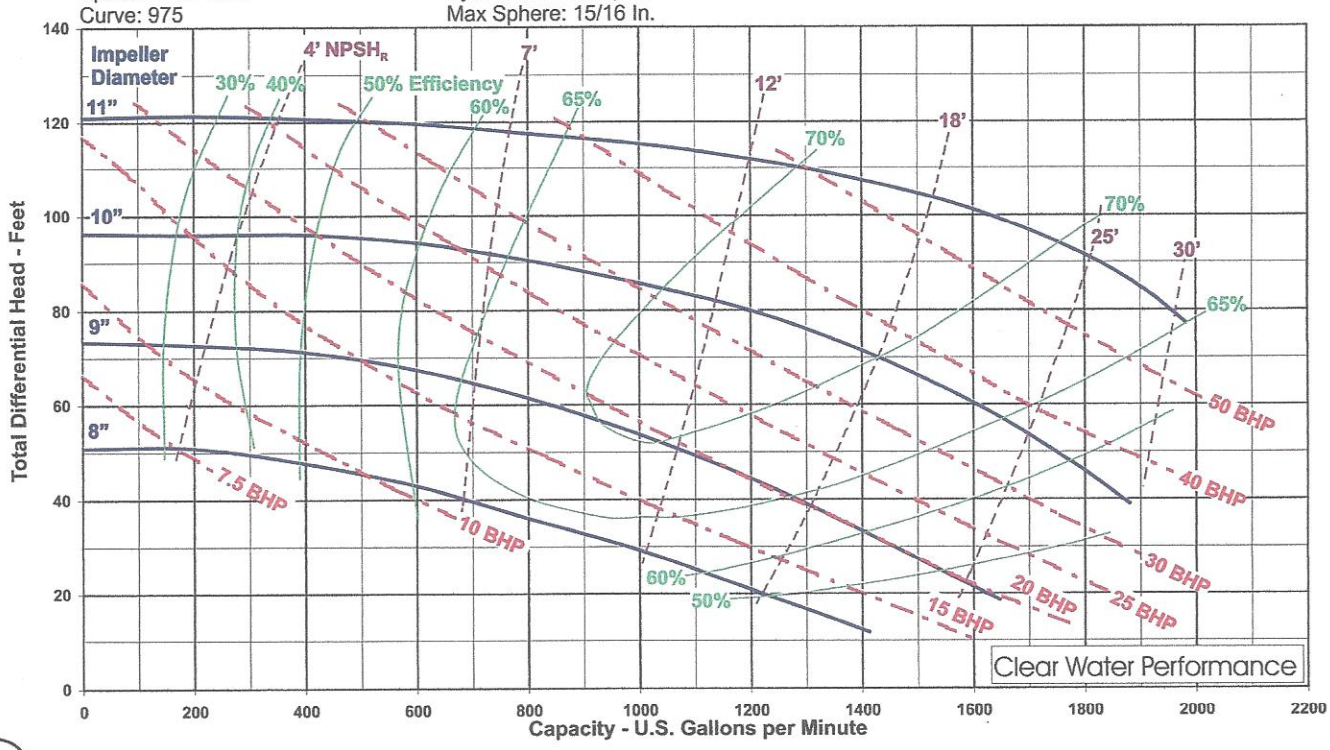
Magnum I
8X6X11
Speed: 1150 RPM
Curve: 974

Open Impeller
Dia: 8" to 11"
Eye Area: 28.3 Sq. In.
Max Sphere: 15/16 In.



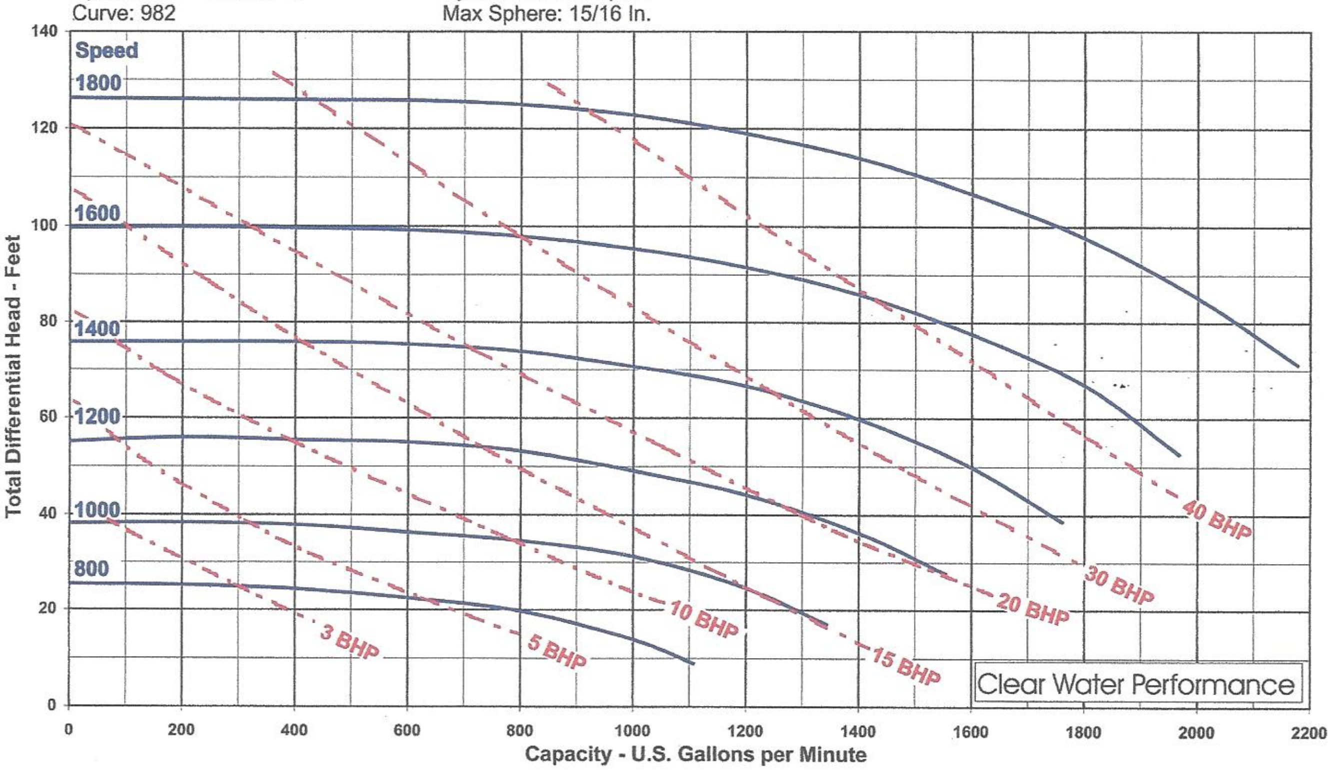
Magnum I
8X6X11
Speed: 1750 RPM
Curve: 975

Open Impeller
Dia: 8" to 11"
Eye Area: 28.3 Sq. In.
Max Sphere: 15/16 In.



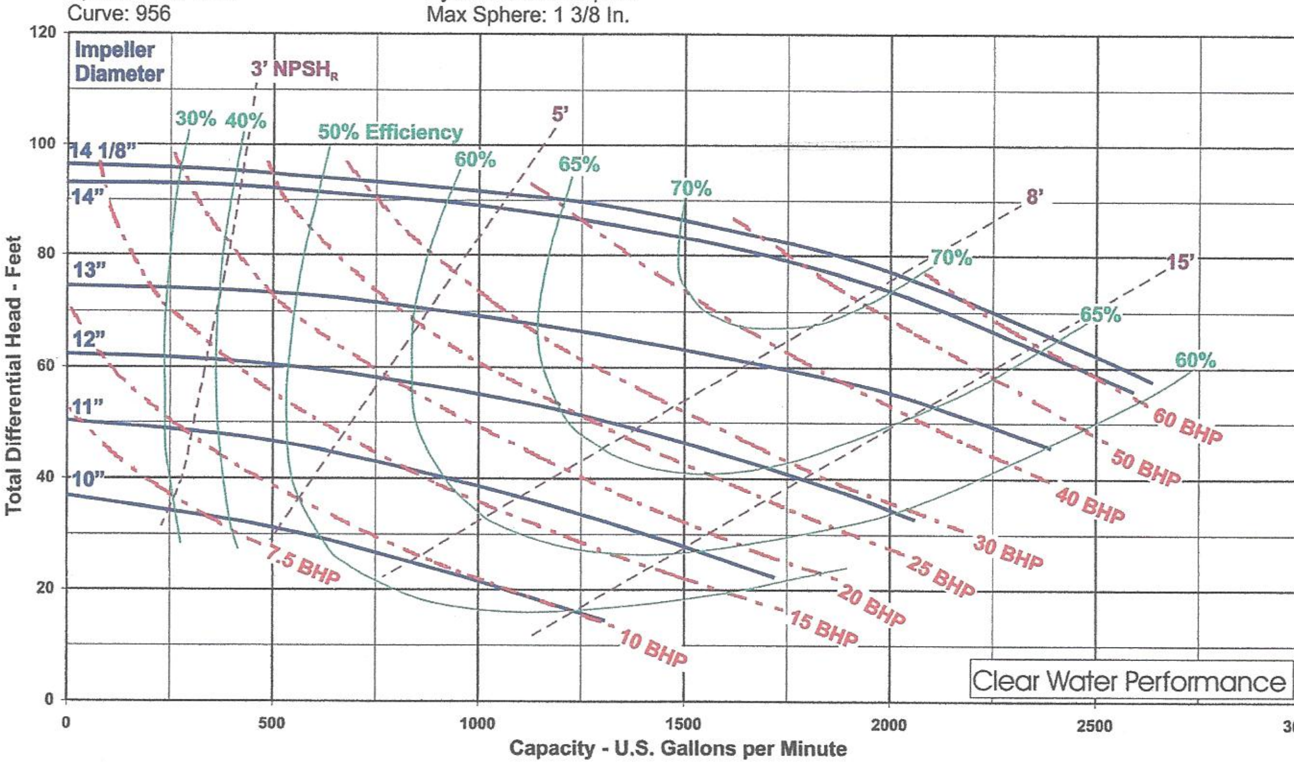
Magnum I
8X6X11
Speed: 800 - 1800 RPM
Curve: 982

Open Impeller
Dia: 11"
Eye Area: 28.3 Sq. In.
Max Sphere: 15/16 In.



Magnum I
8X6X14
Speed: 1150 RPM
Curve: 956

Open Impeller
Dia: 10" to 14 1/8"
Eye Area: 50.3 Sq. In.
Max Sphere: 1 3/8 In.



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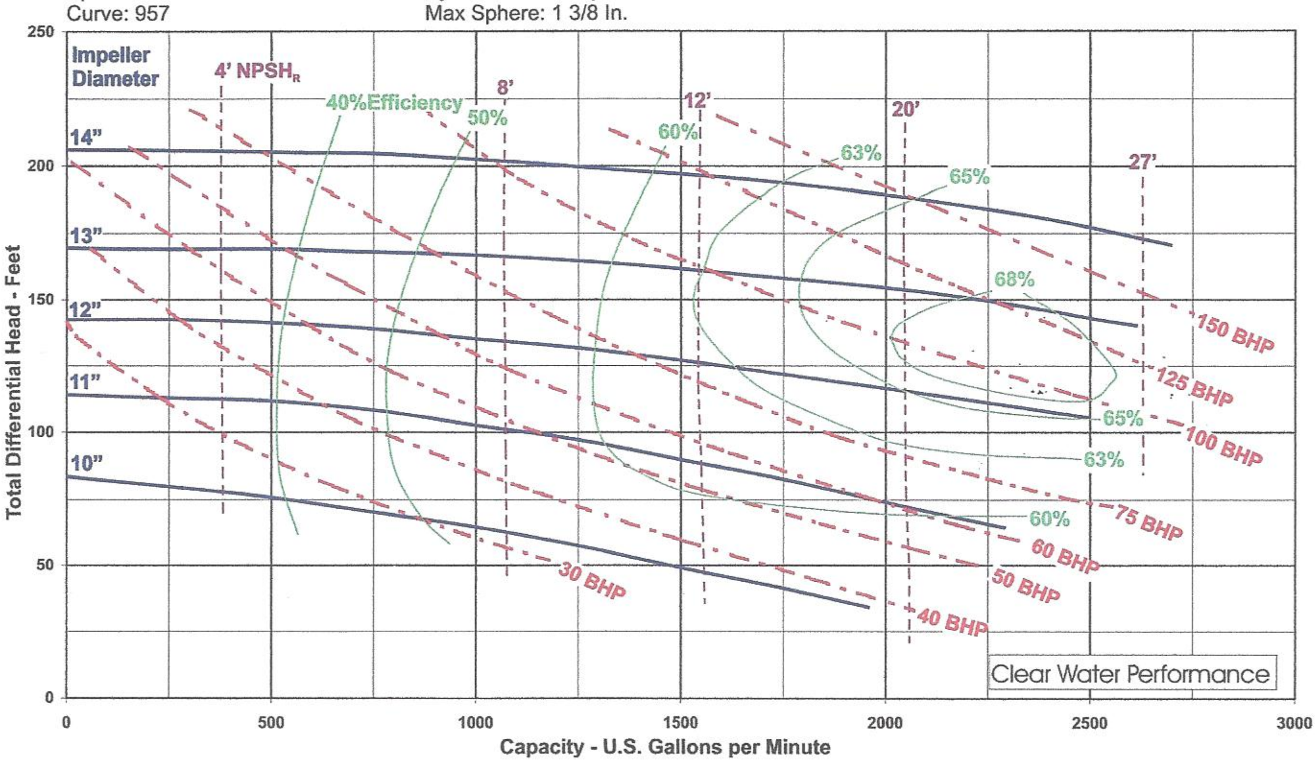
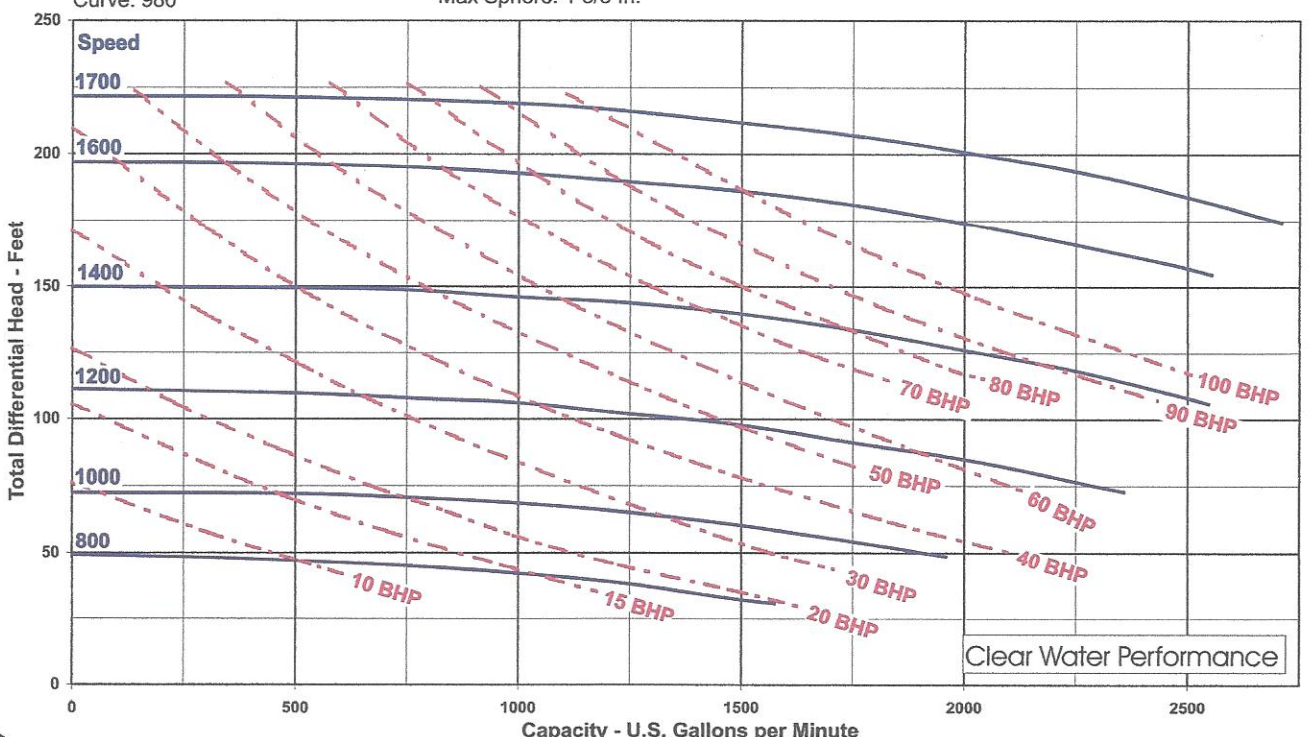
Magnum I
8X6X14
Speed: 1750 RPM
Curve: 957

Open Impeller
Dia: 10" to 14"
Eye Area: 50.3 Sq. In.
Max Sphere: 1 3/8 In.



Magnum I
8X6X14
Speed: 800 - 1700 RPM
Curve: 980

Open Impeller
Dia: 14 1/8"
Eye Area: 50.3 Sq. In.
Max Sphere: 1 3/8 In.



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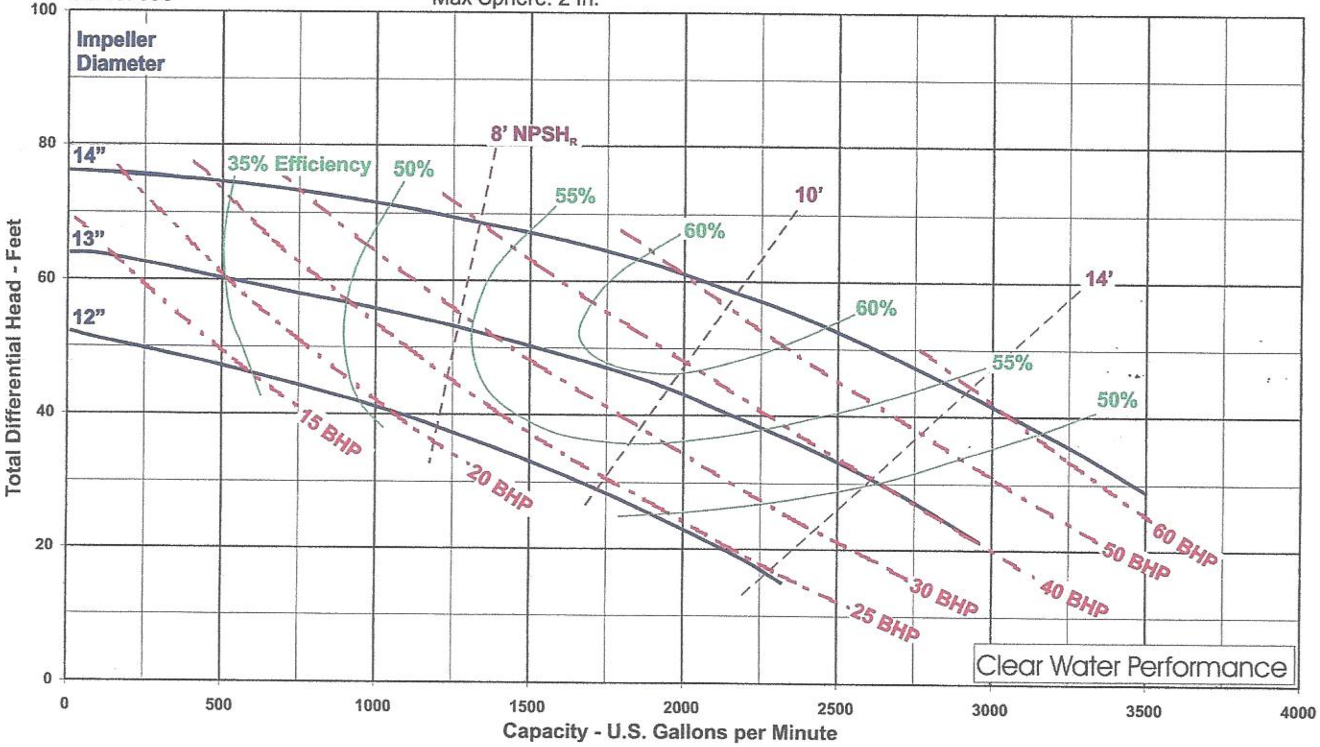
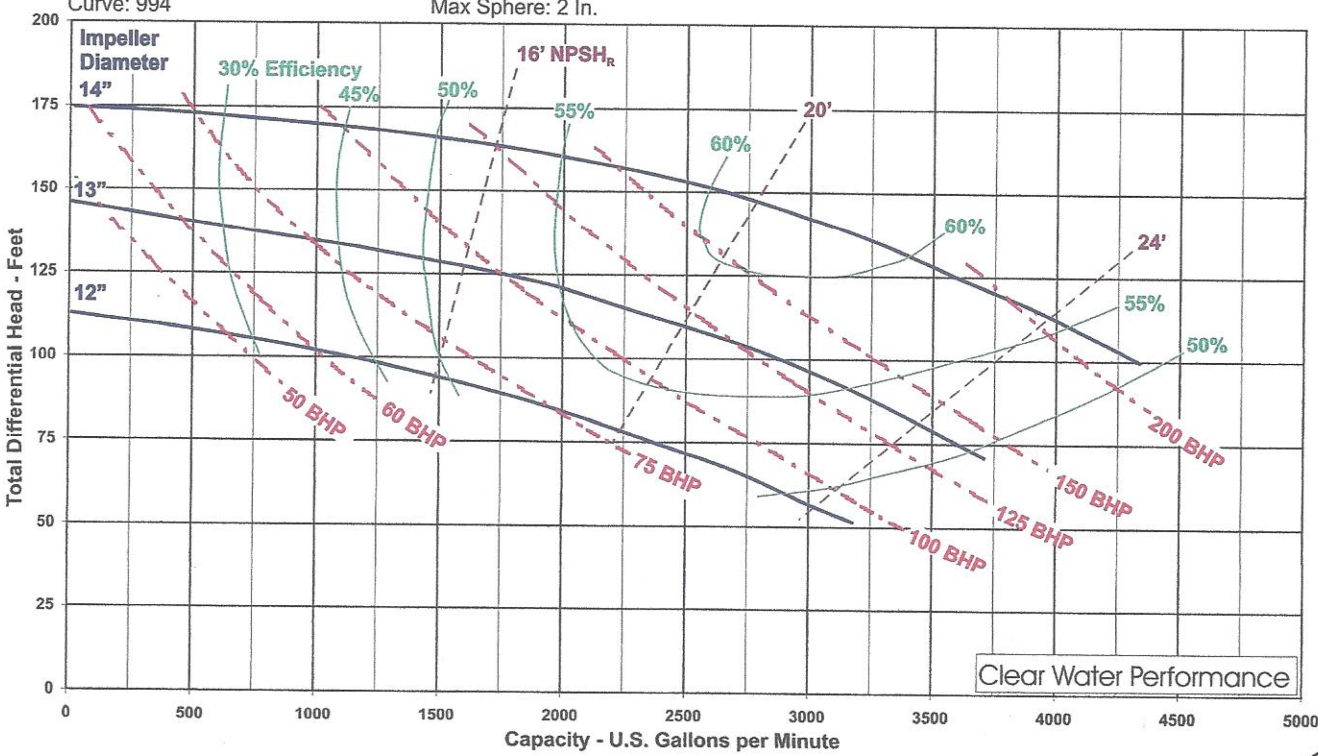
Magnum I
10X8X14
Speed: 1150 RPM
Curve: 993

Open Impeller
Dia: 12" to 14"
Eye Area: 63 Sq. In.
Max Sphere: 2 In.



Magnum I
10X8X14
Speed: 1750 RPM
Curve: 994

Open Impeller
Dia: 12" to 14"
Eye Area: 63 Sq. In.
Max Sphere: 2 In.



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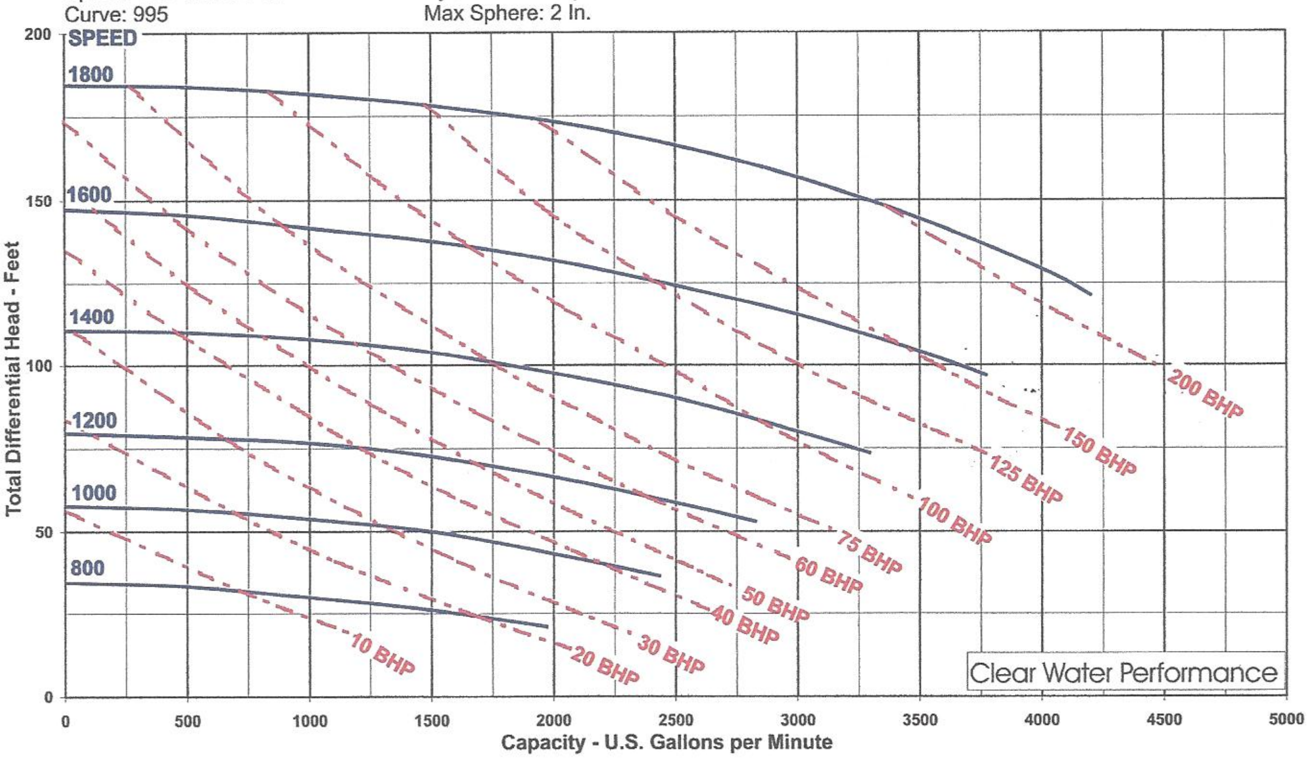
Magnum I
10X8X14
Speed: 800-1800 RPM
Curve: 995

Open Impeller
Dia: 14 1/8"
Eye Area: 63 Sq. In.
Max Sphere: 2 In.



Magnum XP
8X6X18
Speed: 1750 RPM
Curve: 86817

Open Impeller
Dia: 15" to 18"
Max Sphere: 3/4"