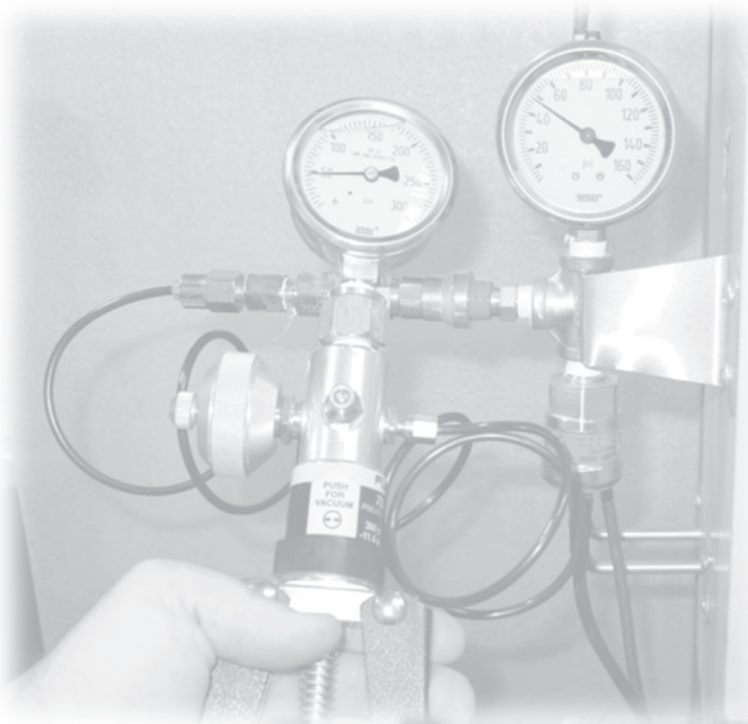


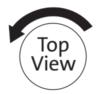
CR
Troubleshooting

CONTENTS

Pump Won't Start

Possible Cause	Check This By. . .	Correct This By. . .
No power at the motor	Check for voltages at the motor's terminal box. See page 9 for instructions.	If there is no voltage at the motor, check the feeder panel for tripped circuits and reset those circuits.
Fuses are blown or the circuit breakers have tripped	Turn off the power and remove the fuses. Check for continuity with an ohmmeter.	Replace the blown fuses or reset the circuit breaker. If the new fuses blow or the circuit breaker trips,the electrical installation, motor, and wires must be checked for defects.
Motor starter overloads are burned or have tripped	Check for voltage on the line and load side of the starter. Check the amp draw and make sure the heater is sized correctly.	Replace any burned heaters or reset. Inspect the starter for other damage. If the heater trips again, check the supply voltage. Ensure that heaters are sized correctly and the trip setting is appropriately adjusted.
Starter does not energize	Energize the control circuit and check for voltage at the holding coil.	If there is no voltage, check the control circuit fuses. If there is voltage, check the holding coil for weak connections. Ensure that the holding coil is designed to operate with the available control voltage. Replace the coil if defects are found.
Defective controls	Check all safety and pressure switches for defects. Inspect the contacts in control devices.	Replace worn or defective parts or controls.
Motor is defective	Turn off the power and disconnect the wiring. Measure the lead-to-lead resistance with an ohmmeter (set to R x 1). Measure the lead-to ground values with an ohmmeter (set to R x 100K). See page 10 for instructions. Record these measurements and compare them to the rated values for your motor.	If an open or grounded winding is found, remove the motor and repair or replace it.
Defective capacitor (on single phase motors only)	Turn off the power and discharge the capacitor by shorting the leads together. Check it with an analog ohmmeter (set to R x 100K). See page 9 for instructions.	When the meter is connected to the capacitor, the needle should jump toward 0 (zero) ohms and slowly drift back to infinity (∞). Replace the capacitor if it is defective.
The pump is stuck	Turn off the power and manually rotate the pump shaft.	If the pump shaft doesn't rotate, remove the pump and examine it. If necessary, disassemble it and check the impellers and seal for possible obstruction.

Pump Runs, But Does Not Produce Enough Flow (GPM)

Possible Cause	Check This By. . .	Correct This By. . .
Shaft is turning in the wrong direction	 Check the rotation of the coupling or motor fan. It should be rotating counterclockwise when viewed from the top. Check the wiring for proper connections.	Correct the wiring. For single phase motors, check the wiring diagram on the motor. For three phase motors, simply switch any two power leads.
Pump is not primed or is airbound	Turn the pump off, close the isolation valve(s), and remove the priming plug. Check the level of the water within the pump.	Refill the pump, replace the priming plug, and start the pump (any long suction lines should first be filled with water before starting the pump).
The strainers, check valves, or foot valves are clogged	Remove and inspect the strainer, screen, or valves.	Clean and replace any defective strainers, screens, or valves.
Not enough NPSH available	Install a compound pressure gauge at the suction side of the pump. Start the pump and compare the reading to the published performance and NPSH data for that pump.	Reduce the suction lift required of the pump by lowering the pump, increasing the suction line size, or removing high friction loss devices on the suction line.
There are leaks in the suction or discharge piping	Check the piping for leaks with soapy water. Watch the shaft immediately after the pump is turned off. If it runs backward, there may be leaks.	The suction pipe, valves, and fittings must be made tight. Repair any leaks and retighten all loose fittings.
Parts or fittings in the pump are worn	Install a pressure gauge near the discharge port, start the pump, and gradually close the discharge valve. Read the pressure at shutoff. (Do not allow the pump to operate for an extended period at shutoff.)	Convert the PSI you read on the gauge to Feet of Head by: $\frac{\text{PSI x 2.31 ft/PSI}}{\text{Specific Gravity}} = \_\_\_\_\_\ \text{ft.}$ Refer to the pump curve for the model you are working with to determine the shutoff head you should expect for that model. If that head is close to the figure you came up with (above), the pump is probably OK. If not, remove the pump and inspect impellers, chambers, etc.
Impellers are clogged	Install a pressure gauge near the discharge port. Bleed off any pressure in the tank or boiler. Start the pump and gradually close the discharge valve. Read the pressure at shutoff. Open the valve very slowly, noting the discharge pressure reading.	If the discharge pressure drops very little ($<$ 20 psi) through several turns of the valve, the pump is probably OK. If it drops more quickly, an impeller or chamber may be clogged. Disassemble the pump and inspect the impellers, chamber, etc.
Incorrect Supply Voltage or Motor Wiring Combinations Do Not Match Voltage Supply	Check for voltages at the motor's terminal box. See page 9 for instructions.	If the wrong voltage is found, correct. If the motor wiring combination allows for multiple supply voltages, change wiring combination to match supplied voltage.

Pump Runs, But Cycles Too Often

Possible Cause	Check This By. . .	Correct This By. . .
The pressure switch is defective or is not properly adjusted	Check the pressure setting on the switch. Check the voltage across closed contacts.	Readjust the pressure switch or replace it if defective.
The level control is defective or is not properly set	Check the setting and operation of the level control	Readjust the level control setting (according to the manufacturer's instructions) or replace it if defective.
There is insufficient air charging of the tank, or piping is leaking	Pump air into the tank or diaphragm chamber. Check the diaphragm for leaks. Check the tank and piping for leaks with soapy water. Check the air-to-water ratio in the tank.	Repair as necessary.
The tank is too small	Check the tank size and amount of air in the tank. The tank volume should be approximately 10 gallons for each Gallon-Per-Minute of pump capacity. At the pump cut-in pressure, the tank should be about 2/3 filled with air.	Replace the tank with one that is the correct size.
Pump is sized incorrectly (too large)	Check the flow required by the system.	Reduce the flow by throttling back on the pump's discharge side **(NEVER ON THE SUCTION SIDE)**. or change the pump.

Pump Runs, But Fuses Blow or Heaters Trip

Possible Cause	Check This By. . .	Correct This By. . .
Improper voltage	Check the voltage at the starter panel and the motor. See page 9 for instructions.	If the voltage varies by more than 10% (+ or -), contact the power company.
The starter overloads are set too low	Cycle the pump and measure the amperage. See page 8 for instructions.	Increase the heater size or adjust the trip setting. Do not, however, exceed the recommended rating.
The three-phase current is imbalanced	Check the current draw on each lead to the motor. See page 8 for instructions.	The current draw on each lead must be within 5% of each other (+ or -). If they are not, check the wiring.
The motor is shorted or grounded	Turn off the power and disconnect the wiring. Measure the lead-to-lead resistance with an ohmmeter (set to R x 1). Measure the lead-to-ground resistance with an ohmmeter (set to R x 100K) or a megaohmmeter. Record these measurements and compare them to the rated values for your motor.	If you find an open or grounded winding, remove the motor and replace/repair it.
The wiring or connections are faulty	Check to make sure the wiring combinations are correct and there are no loose terminals.	Change wiring combinations in the motor terminal box to match supply voltage. Tighten any loose terminals and replace any damaged wire.
The pump is stuck	Turn off the power and manually rotate the pump shaft.	If the pump shaft does not rotate, remove the pump and examine it. If necessary, disassemble it and check the impellers and seal for possible obstruction.
Capacitor is defective (single phase motors only	Turn off the power and discharge the capacitor. Check the capacitor with an ohmmeter (set at R x 100K). See page 9 for instructions.	When the meter is connected to the capacitor, the needle should jump towards 0 (zero) ohms and then slowly drift back to infinity (∞). Replace the capacitor if it is defective.

Pump Runs, But Makes Noise

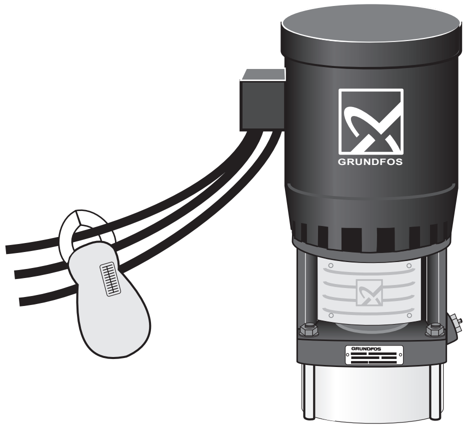
Possible Cause	Check This By. . .	Correct This By. . .
Motor fan is dragging	Remove the motor fan cover. Inspect the fan and end bell for signs of contact.	Loosen the motor fan and move it to a higher or lower position on the motor shaft end.
Pump is cavitating	Install a compound gauge on the suction port's pressure tap. Turn the pump and read the suction pressure. Record this figure and compare it to the vapor pressure of the fluid and the pump unit's NPSH required (at its operating point on the performance curve).	Either: • Increase the static suction head, and/or • Decrease the fluid temperature, and/or • Decrease the friction losses in the suction piping. If this doesn't work, throttle back on the pump's discharge side **(NEVER ON THE SUCTION SIDE).**
Air is mixed in with the pumped fluid	Turn the pump off, close the isolation valve (s), and remove the priming plug. Check the level of the water within the pump... or Check the supply tank for whirling or cascading fluid at the outlet to the pump.	Turn off the pump and close the isolation valves. Refill the pump, replace the priming plug, and start the pump (any long suction lines should be filled with water before starting the pump).
Impeller is dragging on a chamber	Check the height of the coupling to make sure there is sufficient vertical "play" in the shaft. Turn the coupling by hand, etc.	Adjust the height of the coupling as needed.
Other pump problem	Check the amperage being drawn by the motor. Turn the coupling by hand, etc.	If the motor is drawing high amperage, disassemble the pump and check for worn spacers, impellers, etc.
System Pipe Strain	Loosen companion flanges attached to the pump	If system piping moves away from the pump flanges more than 1/8 of an inch in any direction, the system piping needs to be corrected. Pipe strain can cause leakage at sleeve gasket, seal area, and cause binding to pump shaft rotation.

Pump Runs, But Leaks

Possible Cause	Check This By. . .	Correct This By. . .
Sleeve gasket is leaking	Check for leakage at the top and bottom of the sleeve.	Ensure the staybolt nuts are tightened to the proper torque and in an even manner (refer to the Dismantling and Reassembly section for proper torques). If they are tightened correctly and the leak persists, remove the motor stool and inspect the sleeve gasket. If torn or out of position, replace or reposition the gasket.
Mechanical shaft seal is worn	Check for leakage coming from the pump shaft beneath the coupling.	Loosen the coupling and work the pump shaft up and down several times. Vent the pump again and reset the coupling to its proper height. If the leak persists, disassemble the pump and examine the shaft seal, replacing any parts showing significant wear.
Flange is adjusted improperly	Check for leakage between the companion flanges and the pump ports.	Tighten the flange bolts evenly and firmly. If the leak persists, remove the flange and reposition the flange gasket.
Pump housing, outer sleeve, flange, or motor stool is damaged	Check the condition of the pump at the point it is leaking.	If the leakage is coming from an area other than those already listed above, one or more parts may be damaged. Disassemble the pump and check all parts for wear, replacing as necessary.
System Pipe Strain	Loosen companion on flanges attached to the pump.	If system piping moves away from the pump flanges more than 1/8 of an inch in any direction, the system piping needs to be corrected. Pipe strain can cause leakage at sleeve gasket, seal area, and cause binding to pump shaft rotation.

Amperage Check

To check the current of electricity as it flows through wiring (as measured in amperes, or "amps") use an ammeter.



Instructions

1. Make sure the pump is running.
2. Set the rotary scale on the front of the ammeter to 100 amps.
3. Place the tongs of the ammeter around the leg to be measured.
4. Slowly rotate the scale on the ammeter back towards 0 (zero) until an exact reading is shown.
5. Record the measurement.
6. Repeat for the other legs.

Evaluation

If the amp draw exceeds the service factor amps for the pump (as listed in the Motors section of the Service Manual), then:

- The motor starter may have burned contacts.
- The terminals in the starter or terminal box may be loose.
- There may be a winding defect. Check the winding and insulation resistance (see page 10).
- The motor windings may be shorted.
- The pump may be damaged in some way and may be causing a motor overload.
- A voltage supply or balance (3-phase only) problem may exist. Follow the steps below to determine if this is the case.

Checking for Current Imbalance on Three-Phase Motors

If the motor is connected to three-phase power, the balance of those three phases can be checked in the following way:

1. Measure the amperage of each leg as instructed above and record these figures.
2. Add together the total amperage measured by the three legs.
3. Divide this number by three to get the **average** amperage reading for the three legs.
4. Check over your numbers and determine which leg has the greatest difference from the average.
5. Take that number and subtract it from the average to determine the amount of **difference**.
6. Divide the difference by the average.
7. Multiply this number by 100 to obtain the percent of current imbalance for that particular hookup.
8. Turn **POWER OFF**.
9. Repeat these steps for the other two possible hookup installations so that each motor lead is connected to a different power lead than it was before.

	Hookup 1	Hookup 2	Hookup 3
Incoming power leads	L1 L2 L3	L1 L2 L3	L1 L2 L3
Motor leads	A B C	C A B	B C A

(Where A, B, and C represent each motor lead or each set of leads joined together to make a single motor lead)

Example:

Hookup 1	Hookup 2	Hookup 3
A = 52 amps	C = 50 amps	B = 51 amps
B = 48 amps	A = 47 amps	C = 53 amps
C = 50 amps	B = 47 amps	A = 49 amps
Total = 150	Total = 144	Total = 153
150/3 = 50	144/3 = 48	153/3 = 51
-52 = 2	-50 = 2	-49 = 2
2/50 = .01 or 1%	2/48 = .04 or 4%	2/50 = .01 or 1%

Evaluation

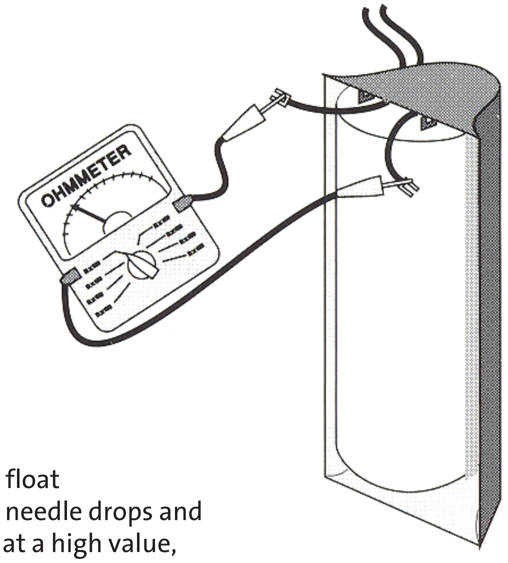
If the current imbalance is greater than 5% on all three installations, then:

- If the largest difference in amps is consistently drawn from the same power lead (L1, L2, or L3 above), contact the power company. Your voltage should be balanced to within 1%.
- If the largest difference in amps is consistently drawn from the same motor lead (A, B, or C above), there is probably a problem with the motor. Check the items listed under "Evaluation" near the top of this page.

If the current imbalance does not exceed 5% on any of the combinations, use the installation that has the least difference and check the motor for some of the other problems listed under "Evaluation" near the top of this page.

Capacitor Check

To check the condition of the capacitor on single phase motors, use an ohmmeter (or megaohmmeter).



Instructions

1. Turn the **POWER OFF**.
2. Disconnect the capacitor from the power source.
3. Discharge the capacitor by touching its leads together.
4. Set the scale selector on the ohmmeter to R x 100K.
5. Connect the leads of the ohmmeter to the black (positive) and orange (negative) wires of the capacitor.
6. Watch the ohmmeter scale.

Evaluation

If the capacitor is OK, the needle should swing towards 0 (zero) and then float back towards infinity (∞) when the leads are touched together. If the needle drops and remains at zero, the capacitor is probably shorted. If the needle remains at a high value, there is an open circuit.

Supply Voltage Check

To check the voltage being supplied to the motor, use a voltmeter.

Instructions

1. Set the voltmeter to the "voltage" scale (if you are using a combination ammeter-voltmeter, such as an ammeter).
2. Remove the cover of the motor terminal box
   BE CAREFUL — POWER IS STILL BEING SUPPLIED TO THE PUMP.
3. Touch the ends of the voltmeter leads as follows:

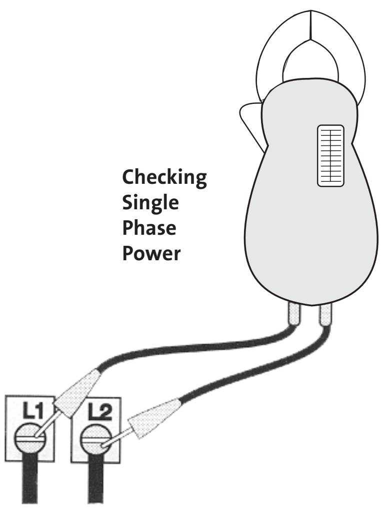
   Single Phase Motors
   Touch one voltmeter lead to each of the lines supplying power to the pump (L_1 and L_2, or L_1 and N for 115V circuits).

   Three Phase Motors
   Touch a voltmeter lead to:

   - Power leads L_1 and L_2
   - Power leads L_2 and L_3
   - Power leads L_3 and L_1
   - Two fuses
   - Two contact points
   - Two heaters

   These tests should give a reading of full line voltage.

Checking Single Phase Power



Evaluation

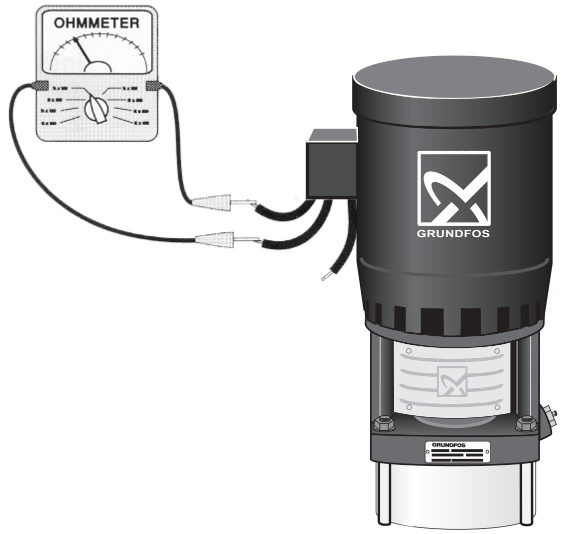
When the motor is under load, the voltage should be within 10% (+ or -) of the nameplate voltage. Any variation larger than this can cause damage to the motor windings and should be noticeable as a high amp problem.

If the Motor Nameplate Reads. . .	Then the minimum and maximum voltage should be . . . Minimum	Maximum
115V (single phase)	105 volts	125 volts
208V (single or three phase)	188 volts	228 volts
230V (single or three phase)	210 volts	250 volts
460V (three phase)	414 volts	506 volts
575V (three phase)	518 volts	632 volts

Any variations larger than these indicate a poor electrical supply. The motor should not be operated under these conditions. Contact your power supplier to correct the problem or change the motor to one requiring the voltage you are receiving.

Motor Winding Resistance (lead-to-lead)

To check the electrical condition of the motor windings, a winding resistance check with an ohmmeter is required.



Instructions

1. Turn the **POWER OFF**.
2. Disconnect all electrical leads to the motor.
3. Set the scale selector on the ohmmeter to R x 1 (if you expect ohm values under 10) or R x 10 (for ohm values over 10).
4. Touch the leads of the ohmmeter to two motor leads:

   Single Phase Motors
   Touching the leads of the ohmmeter to the two outgoing "hot" motor leads (either a single motor lead or combination of leads joined together) will measure the main winding's resistance.

   Three Phase Motors
   Touching the leads of the ohmmeter to any two hot leads will measure that winding's resistance. Repeat for all three possible lead combinations (L_1 and L_2; L_2 and L_3; L_1 and L_2).

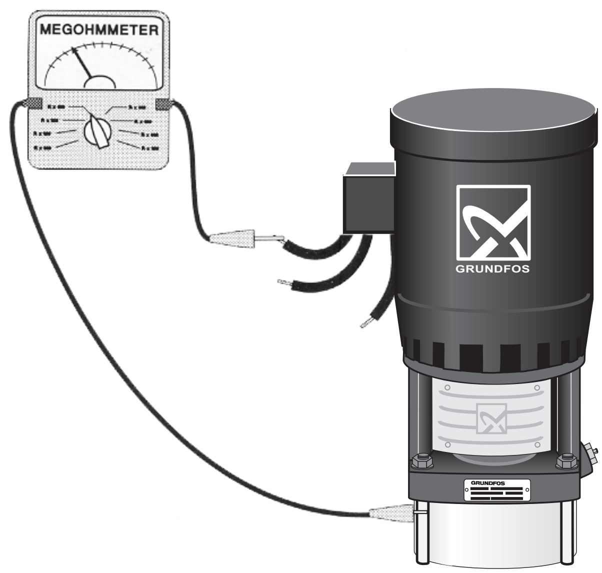
5. Watch the ohmmeter scale and compare this figure with the appropriate chart in the Motors section of this manual.

Evaluation

If all ohm values are normal, the motor windings are neither shorted nor open. If any one ohm value is less than normal, that motor winding may be starting to short. If any one ohm value is greater than normal, the winding may be starting to open. If some ohm values are greater than normal (more than 25%) and some are less than normal (more than 25%), the leads may be connected incorrectly.

Insulation Resistance (lead-to-ground)

To check the insulation resistance of the motor and leads, a megohmmeter is required.



Instructions

1. Turn the **POWER OFF**.
2. Disconnect all electrical leads to the motor.
3. Set the scale selector on the megohmmeter to R x 100, touch its leads together, and adjust the indicator to zero.
4. Touch the leads of the megohmmeter to each of the motor leads and to ground (i.e., L_1 to ground; L_2 to gound, etc.):
5. Watch the megohmmeter scale and compare this figure with the appropriate chart in the Motors section of this manual.

Evaluation

The resistance values for new motors must exceed 1,000,000 ohms. If they do not, replace the motor.

Formulas

NET POSITIVE SUCTION HEAD (two types)

1 NPSHA

Net Positive Suction Head **Available** To A Pump

The NPSHA describes the amount of head that is available to prevent vaporization (or cavitation) in the system. It is the amount of head available above the vapor pressure of the liquid **at a specified temperature**. It can be calculated using the formula at the right.

(the suction side of the pump)

= ① ± ② − ③ − ④

① Absolute pressure of the liquid being pumped

(PSI x 2.31)
Specific Gravity

② Static height that the liquid level is above or below the suction port

③ Friction losses in the suction line

④ The fluid's vapor pressure at the termperature at which it is being pumped

These figures are always expressed in terms of **feet of liquid**. NPSH is always a **positive** number number of feet.

2 NPSHR

Net Positive Suction Head **Required** By A Pump So It Can Operate Without Cavitating

= Determined by extensive testing of the pump by the manufacturer. These requirements are normally shown in graphical form (an NPSH curve) for a pump at every flow (GPM) within the flow range for which the pump is designed. As a pump's flow (GPM) increases, the NPSHR needed to continue that flow (without cavitating) also increases.

IF THE NPSHA IS NOT GREATER THAN THE NPSHR (BY AT LEAST 2 FEET), THE PUMP WILL CAVITATE and HEAD PERFORMANCE WILL BE REDUCED

HEAD
(in feet)

$$= \frac{\text{Pressure (PSI) x 2.31}}{\text{Specific Gravity (for water, 1.0 at ambient temperatures)}}$$

PRESSURE
(PSI)

$$= \frac{\text{HEAD (in ft.) x Specific Gravity (for water, 1.0 at ambient temperatures)}}{2.31}$$

ATMOSPHERIC PRESSURE
Pressure of the Atmosphere Pushing Down (at sea level)

= 14.7 PSI = 34 feet of HEAD

BRAKE HORSEPOWER
Horsepower Delivered to the Pump Shaft

$$= \frac{\text{GPM x HEAD x Specific Gravity (for water, 1.0 at ambient temps)}}{\text{3960 x Efficiency of Pump}}$$

PUMP EFFICIENCY
Of The Pump

$$= \frac{\text{GPM x HEAD x Specific Gravity}}{\text{3960 x Brake Horsepower}}$$

AFFINITY LAWS

The mathematical relationships which permit the head, capacity, BPH, and NPSH of centrifugal pumps to be predicted based on small changes in impeller diameter size or shaft speed (RPM) changes. These relationships are:

For diameter changes at a constant RPM:

$$\frac{D_1}{D_2} = \frac{GPM_1}{GPM_2}$$

Flow changes in direct proportion to the ratio of the diameter change.

$$\left(\frac{D_1}{D_2}\right)^2 = \frac{H_1}{H_2}$$

Head changes to the square ratio of the ratio of the diameter change.

$$\left(\frac{D_1}{D_2}\right)^3 = \frac{BHP_1}{BHP_2}$$

BHP changes to the cube of the ratio of the diameter change.

For RPM changes:

$$\frac{RPM_1}{RPM_2} = \frac{GPM_1}{GPM_2} \qquad \left(\frac{RPM_1}{RPM_2}\right)^2 = \frac{NPSH_1}{NPSH_2}$$

$$\left.\begin{aligned}\left(\frac{RPM_1}{RPM_2}\right)^2 &= \frac{H_1}{H_2}\\ \left(\frac{RPM_1}{RPM_2}\right)^3 &= \frac{BHP_1}{BHP_2}\end{aligned}\right\}$$

Head is affected by the square of the ratio of RPM change.
and
BHP is affected by the cube of the ratio of the RPM change.

Metric Conversions

To Convert This. . .	To This. . .	Multiply By. . .
Q (m^3/h) Cubic meters of flow per hour	**GPM** Gallons Per Minute	Q (m^3/h) x 4.4
Q (l/s) Liters of flow per second	**GPM** Gallons Per Minute	l/s x 15.85
P (kw) Kilowatts of power	**HP** Horsepower	kw x 1.34 or kw/.746
BAR Of Pressure	**PSI Absolute (PSIA)** Pounds per-square-inch of pressure (includes atmospheric pressure at sea level)	(BAR x 14.5) + 14.7
BAR Of Pressure	**PSI Gauged (PSIG)** Pounds per-square-inch of pressure as it would be read on a pressure gauge (**does not** include atmospheric pressure)	BAR x 14.5
METER	**Feet**	Meter x 3.281
Nm **NEWTON METER** Measure of torque	**Ft. lbs.** Foot pound of torque	Nm x .7376
C° Degrees Celsius	**F°** Degrees Farenheit	C°(9/5) + 32
Watts	**Btu/hr** British thermal units per hour	Watts x 3.4127

Water Vapor Pressure and Specific Gravity

°F	°C	Specific Gravity (1 at 60°F)	Weight (Lbs. per cubic foot)	Vapor Pressure (PSIA)	Vapor Pressure (in feet)
32	0	1.002	62.42	0.0885	0.204
40	4.4	1.001	62.42	0.1217	0.281
45	7.2	1.001	62.40	0.1475	0.340
50	10.0	1.001	62.38	0.1781	0.411
55	12.8	1.000	62.34	0.2563	0.591
60	15.6	1.000	62.34	0.2563	0.591
65	18.3	.999	62.31	0.3056	0.839
70	21.1	.999	62.27	0.3631	0.839
75	23.9	.998	62.24	0.4298	0.994
80	26.7	.998	62.19	0.5069	1.172
85	29.4	.997	62.16	0.5959	1.379
90	32.2	.996	62.11	0.6982	1.617
95	35.0	.995	62.06	0.8153	1.890
100	37.8	.994	62.00	0.9492	2.203
110	43.3	.992	61.84	1.275	2.965
120	48.9	.990	61.73	1.692	3.943
130	54.4	.987	61.54	2.223	5.196
140	60.0	.985	61.39	2.889	6.766
150	65.6	.982	61.20	3.718	8.735
160	71.1	.979	61.01	4.741	11.172
170	76.7	.975	60.79	5.992	14.178
180	82.2	.972	60.57	7.510	17.825
190	87.8	.968	60.35	9.339	22.257
200	93.3	.964	60.13	11.526	27.584
212 ***(boiling point)***	100.0	.959	59.81	14.696	35.353
220	104.4	.956	59.63	17.186	41.343
240	115.6	.948	59.10	24.97	60.77
260	126.7	.939	58.51	35.43	87.05
280	137.8	.929	58.00	49.20	122.18
300	148.9	.919	57.31	67.01	168.22
320	160.0	.909	56.66	89.66	227.55
340	171.1	.898	55.96	89.66	227.55
360	182.2	.886	55.22	153.04	398.49
380	193.3	.874	54.47	195.77	516.75
400	204.4	.860	53.65	247.31	663.42
420	215.6	.847	52.80	308.83	841.17
440	226.7	.833	51.92	381.59	1056.8
460	237.8	.818	51.02	466.9	1317.8
480	248.9	.802	50.00	566.1	1628.4
500	260.0	.786	49.02	680.8	1998.2

Water Properties at Different Altitudes

ALTITUDE		BAROMETER READING		ATMOSPHERIC PRESSURE		Boiling Point of Water F°
Feet	*Meters*	*IN. HG.*	*MM. HG.*	*PSIA*	*Feet of Water*	
-1000	-304.8	31.0	788	15.2	35.2	213.8
-500	-152.4	30.5	775	15.0	34.6	212.9
0	**0.0**	**29.9**	**760**	**14.7**	**33.9**	**212.0**
+500	+152.4	29.4	747	14.4	33.3	211.1
+1000	304.8	28.9	734	14.2	32.8	210.2
1500	457.2	28.3	719	13.9	32.1	209.3
2000	609.6	27.8	706	13.7	31.5	208.4
2500	762.0	27.3	694	13.4	31.0	207.4
3000	914.4	26.8	681	13.2	30.4	206.5
3500	1066.8	26.3	668	12.9	29.8	205.6
4000	1219.2	25.8	655	12.7	29.2	204.7
4500	1371.6	25.4	645	12.4	28.8	203.8
5000	1524.0	24.9	633	12.2	28.2	202.9
5500	1676.4	24.4	620	12.0	27.6	201.9
6000	1828.8	24.0	610	11.8	27.2	201.0
6500	1981.2	23.5	597	11.5	26.7	200.1
7000	2133.6	23.1	587	11.3	26.2	199.2
7500	2286.0	22.7	577	11.1	25.7	198.3
8000	2438.4	22.2	564	10.9	25.2	197.4
8500	2590.8	21.8	554	10.7	24.7	196.5
9000	2743.2	21.4	544	10.5	24.3	195.5
9500	2895.6	21.0	533	10.3	23.8	194.6
10000	3048.0	20.6	523	10.1	23.4	193.7
15000	4572.0	16.9	429	8.3	19.2	184.0

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