NATIONAL PUMP COMPANY, LLC

Betta FLO

SUBMERSIBLE PUMPS
4" - 6" - 8"

INSTALLATION, OPERATION & MAINTENANCE INSTRUCTIONS

READ COMPLETE INSTRUCTIONS CAREFULLY BEFORE ATTEMPTING ANY WORK!

1. IMPORTANT PRECAUTIONS!

1.1 An improperly wired pump constitutes a hazard to health and property. Electrical installation must be performed by qualified personnel. it must conform to the latest requirements of the National Electrical Code (U.S.A.) and any codes in effect at the time of installation. Pay particular attention to the grounding requirements.

1.2 Piping must follow good plumbing practices and it must conform to current applicable local and national codes.

1.3 It is recommended that any installation and service be performed by a National Pump dealer.

1.4 Use of submersible well pumps in open bodies of water such as lakes, swimming pools, etc.., is not recommended due to possible shock hazards.

2. PRELIMINARY CHECKS!

2.1 Electrical power supply should match that shown on the motor nameplate in reguards to voltage, ampacity (current carrying capacity of circuit), phase and frequency in hertz (Hz). Electrical controls such as pressure switches, starters, etc., must be checked for proper sizing.

2.2 Three-wire, single phase motors require a matching control box. Electrical requirements on control box nameplate must match the motor nameplate information. Three-phase motors require a correct size ambient compensated starter with quick trip heaters on all legs. (Note: Heaters are not normally supplied with starters and must be purchased separately.) Two wire motors do not require a control box and are wired directly to automatic switching devices, such as a pressure switch.

2.3 Inspect the pump and motor for any damage incurred in transit.

3. ACCESSORIES

3.1 National Pump offers various accessories that would make a basic water system safer and more reliable. examples are: surge protectors (lightning arrestors), low flo cut-off controls, well seals, presure relief valves, contactors, starters, pressure switches, etc. Installation instructions are normally supplied with the accessories and some are explained elsewhere in this manual. Read the accessories instructions carefully and integrate them with the basic instructions contained in this manual.

4. ELECTRICAL INSTALLATION

4.1 Select the proper size cable. Improper sizing will result in excessive voltage drop and consequently impaired pump performance and efficiency. Refer to Section 8, Tables 1 & 2 for selection chart.

Voltage at the pump should be within 10% of nameplate rating. Example: 115 volt nameplate should have a minimum of 103.5 volts and a maximum of 126.5 volts.

If calculations are used instead of the chart, or if the chart does not show the size being used, start from the service main entrance and continue on to the pump to obtain total cable length.

Voltage Drop = (Total length of cable in feet)
x (Resistance in Ohms per foot)
x (Maximum Amps)

Voltage at Pump = (Service Main Voltage)
- (Voltage Drop)

4.2 Provide a separate fused or circuit breaker-protected branch circuit. Refer to Section 8, Tables 3-6 for fusing (use Type D fuses only) or circuit breaker sizing.

4.3 Install a main disconnect switch in full view and easily accessible from where the pressure switch and pressure tank are located. Refer to Section 9 Wiring Diagrams for typical electrical layouts.

4.4 Proper grounding is a prime requirement for a safe and reliable installation. Follow code requirements such as the National Electrical Code (NEC) or Canadian Standards Association (CSA) Liquid Pump Standards. Use only copper wire for grounding. Proper grounding of Betta Flo submersible pumps may be accomplished in either of two ways: a) use of a metal pipe from the pump discharge head all the way to the pitless adapter (continuous metal path to the well casing) or, b) if plastic pipe is used, a seperate ground wire of the same size as the supply conductors should be installed. Terminate the wire with a 5/16" ring-tongue terminal. On one of the motor mounting studs closest to the motor electrical connector, install the ring-tongue terminal, washer, and an additional nut. Tighten to 10ft.-lbs of torque. Route the ground wire under the cable guard and secure it to the discharge pipe along with the supply-power conductors. Terminate the other end with the proper size ring-tongue terminal and connect it to the metal well casing using approved bonding technique. Continue ground wire and connect it to the supply ground. All above ground controls must be properly bonded to the supply ground.

4.5 Perform all electrical connections from supply to disconnect switch, to pressure switch and to the control box or starter (when required) Do not connect pump cable to the switch (2 wire installation) or control box (3 wire installation) at this point in the installation.

4.6 Installations using packaged cable (AW28) on 4" motors.

4.6.1. Remove cable guard

4.6.2. Remove short "pigtail" on motor, if equipped, by loosening the gland nut holding the connector to the motor completely and pulling connector off.

4.6.3. Inspect the connector on package cable (AW28) for damage and/or dirt in the sockets. Plug connector to the motor making sure male and female parts match and the polarizing slot and key are aligned. Push the connector as far as it will go. Engage the gland nut and tighten until snug. Avoid cross-threading when starting the gland nut.

4.6.4. Lay cable flat against pump and install cable guard. Check that the cable is not pinched anywhere along the guard. Proceed to Section 4.8 for the remainder of the installation.

4.7 Installations using bulk cable and short lead cable (pigtail) supplied with motor.

4.7.1. Prepare the cable ends by stripping the insulation to expose about 3/8" to 1/2" of the conductors.

4.7.2. If using the heat-shrink tubing method of insulation, slip an appropriate length of tubing over each wire. Splice the wires to the motor pigtail using the proper crimping tool and compression sleeves. Observe color coding. To insure a good connection and a strong splice, solder may be applied to the joint after crimping. Solder is mandatory above 5 hp. Use only roisn-core solder.

4.7.3. Position shrink tubing (AW25-Series) over the joint making sure it is centered. Apply heat on the shrink tubing with a flame or a propane torch. If using a torch, keep the flame moving to prevent burning the tubing. Proper shrink is reached when the tubing does not show any further reduction in size and the waxy sealant has started to ooze at the ends.

4.7.4. Check proper sealing of splice by immersing it in a container of water for ten (10) minutes and then taking a resistance reading between the water and each of the cable conductors. Connect one ohmmeter lead to the conductor and the other lead to a piece of metal immersed in the same water. The resistance should be 2 megohms (2 million ohms) or higher. A low resistance indicates an insulation leak and must be corrected.

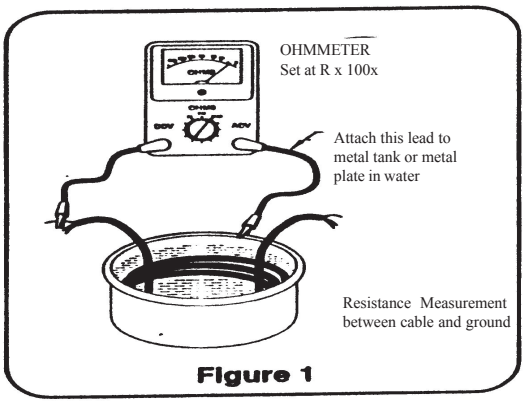


Figure 1

4.7.5. Measure the total resistance of the complete drop cable and motor circuit to insure that a good splice was made. The total resistance should equal the length of the cable in feet, multiplied by the resistance per foot plus the motor winding resistance (Tables 5-8, Section 8). Use the low scale (Rx1) on the ohmmeter for this test. A low reading, compared to what was calculated, indicates a possible short in the cable or motor winding; a high reading (more than double) indicates a high resistance joint, which must be corrected by re-splicing. NOTE: On motors with resistance of one (1) ohm or less, use a bridge-type instrument to measure the resistance. A bridge-type instrument is designed for measuring low resistances. Total Resistance = cable length in feet x resistance per foot + resistance of motor winding. On two wire motors connect the ohmmeter to the two leads to measure the resistance. On three wire motors connect the ohmmeter to the black and yellow to measure the resistance.

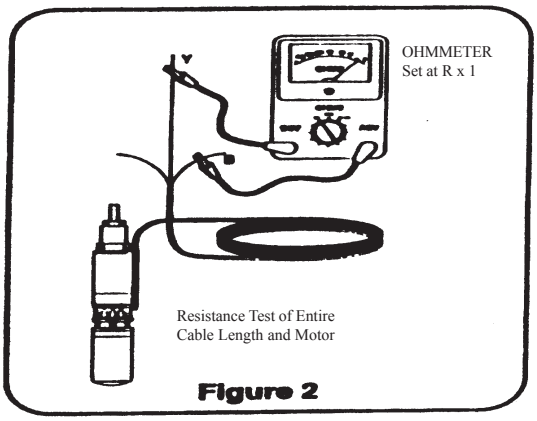


Figure 2

4.8 Complete the electrical connection to the pressure switch, contactor, control box or starter. Refer to typical wiring diagrams. Section 9 to determine the connections appropriate to the installation. Affix motor information sticker in an appropriate location after filling out.

4.9 Surge Arrestors (Lightning Arrestors) It is highly recommended that surge arrestors be installed. Surge arrestors will conduct high voltage surges to ground before they can inflict damage to the motor. Single-phase Franklin Electric motors with model prefix 244 or 214 have integral surge protectors and do not require any additional protection.

Motors without integral surge protection may be protected by either the valve type (indoor-outdoor use) or the expulsion type (outdoor only). Both are available from your National Pump Dealer. Three-phase motors will require three surge protectors. Connect as shown in the instructions accompanying the protectors. In addition, use the following proce dure.

If a protector has already been installed at the lead-in power lines to the user's premises and is within 50 feet of the pump control box or pressure switch installation, no additional protector(s) is required. On overhead supply line longer than 50 feet a protector at the control box is required. In any installation the ground connection determines the effectiveness of the system. Same size wire as supply cable to motor, or larger, bare or stranded, should be used for grounding.

5. INSTALLATION IN THE WELL

5.1 Before connecting any piping to the pump, REMOVE the check valve. Push the poppet on the check valve to insure proper functioning after the prolonged storage. If both checks are acceptable reinstall the check valve. Use pipe sealant on the threads.

5.2 On top-feeding wells and wells that have a much greater diameter than the pump, a sleeve should be used to obtain the necessary water flow around the motor for cooling. Sleeves may be fabricated by the installer. Refer to Section 10 for recommended design and suggested flow around the motor.

5.3 Connect the piping to the pump and carefully lower it in to the well. Caution should be exercised in this operation so as to not injure the drop cable. Fasten cable to the drop pipe at regular intervals, about every 10 feet, with waterproof plastic electrical tape or self-locking plastic bands. Use an approved well cap to properly seal the top of the well and to provide a suitable exit for the power cable and grounding conductor, if required.

5.4 Final pump setting must be at least ten feet from the bottom of the well. It must also be a least ten feet below the maximum well drawdown (water level depth).

If over-pumping a well is a possibility, safeguards must be made through the use of accessories to prevent its occurrence.

5.5 Use of a standard pneumatic tank requires the installation of an air-charging system. Proceed to Section 5.5.1 if this is required. Tanks using a separate air chamber do not require an air charging system Proceed to Section 5.6.

5.5.1 Air Charger Operation and Installation. Pressure storage tanks that are not equipped with a separating membrane between the air cushion and the water will gradually lose the air charge if no provision is made to replenish it. The air charging system for a submersible pump consist of a drain and "Y" fitting (AV11), a snifter valve (AV9), and an air escape control (AA4).

The AV9 is installed on the discharge pipe at a location not subject to freezing. An AV11 is installed between 7 and 20 feet below the AV9 on the same discharge pipe. The AA4 is installed in the pressure tank. In operation, as soon as the pump cuts out, the snifter valve will open to the atmosphere and the drain and "Y" fitting will bleed the water in the pipe between the AV9 and the AV11. On the next pump turn-on, the slug of air in the pipe is forced into the tank because the snifter valve and the "Y" fitting automatically close under pressure. If an excessive amount of air is accumulated in the tank the AA4 will automatically bleed it into the atmosphere.

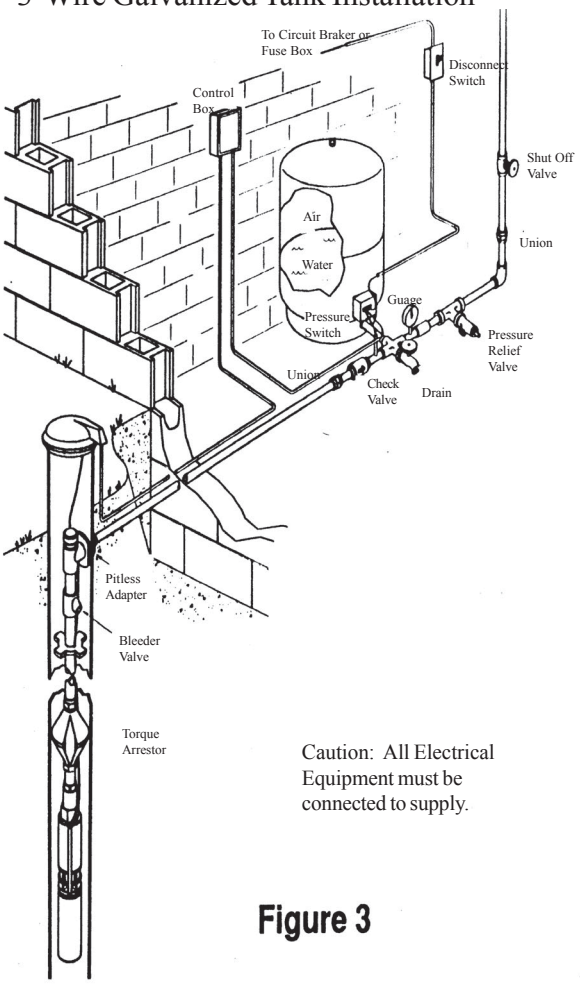
The volume of air charged into the tank per complete on-off cycle is determined by the distance between the AV9 and the AV11. The larger the tank, the greater the required distance, and thus the larger the volume charged. Refer to the following chart to determine approximate setting of drain fittings for different tank sizes.

Approximate Setting for Drain Fittings	
Tank Size Gallons	Depth from Surface To Install Drain Fittings
42	7
82	10
120	15
220	15
315	20
525	20

5.6 A safety-line of corrosion-resistant cable can be attached to the discharge head eye on the pump and secured at the top of the well when using plastic drop pipe. This is to safeguard against losing the pump down the well if the pipe breaks.

TYPICAL INSTALLATIONS

3-Wire Galvanized Tank Installation



Caution: All Electrical Equipment must be connected to supply.

Figure 3

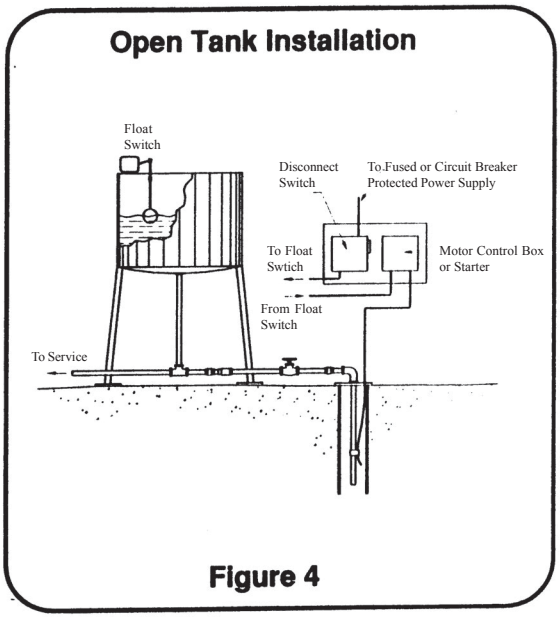


Figure 4

TYPICAL INSTALLATIONS (CONT.)

2-Wire Captive Air Tank Installation

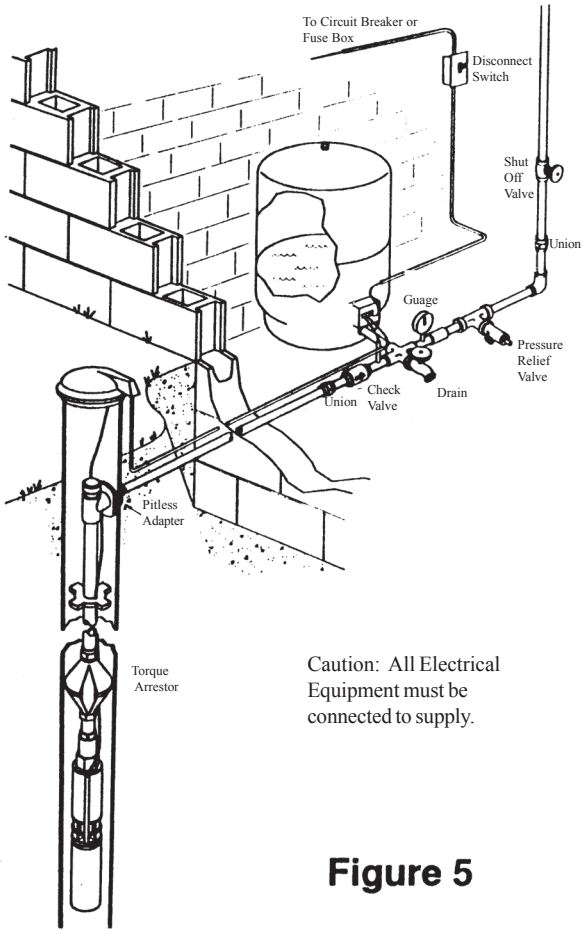


Figure 5

5.7 Piping to the Tank.

5.7.1. A pressure relief valve must be installed as close to the pressure tank as possible if the pump is capable of developing 75 psig or higher discharge pressure. The relief valve should be sized to handle the flow that the pump can produce at 75 psig discharge pressure.

5.8 Make final electrical connections to switch or control box.

6. START-UP AND FINAL CHECKS

6.1 Double-check entire installation paying particular attention to these items:

a.) Pressure switch connection to control check valve and check valve direction, if they are used.
b.) Interconnection of pressure switch to other electrical components of the systems. Refer to Section 9 for wiring diagrams.
c.) Grounding
d.) Shut-off valve locations in the house piping.
e.) Pressure relief valve installation.

6.2 For single phase pumps:

Leave open one faucet in the house. Start pump. Observe pressure buildup and allow water to flow for about a minute. Close the faucet. Pump should stop when pressure reaches the cut-out setting.

6.3 Pressure switch cut-in and cut-out points are adjustable. Refer to instruction card in the pressure switch for procedures. On precharged tanks, the precharge pressure as measured at the Schraeder valve when no water is in the tank, should measure about 2 psig below the cut-in pressure of the switch. Adjust precharge as required.

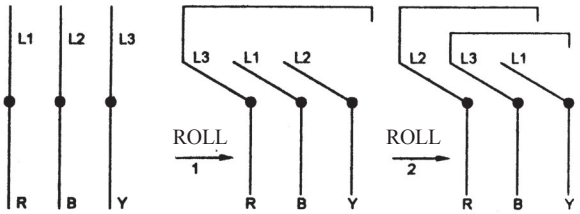
6.4 For three-phase pumps.

Modify the discharge piping so that a full free-discharge flow may be observed. Start the pump and observe rate of flow. Turn power off and reverse any two leads. Start pump and compare flow from the previous one. Combination of con nections resulting in the highest flow rate is the one giving the correct rotation. Check also the current unbalance between the three legs. Unbalanced current could result in the above normal operating temperatures. Maximum unbalance allowable is 5% of the average of the three legs. If an excesssive unbalance is experienced it must be determined if it is caused by the motor or the power supply. "Roll" the leads to the motor by a sequence as follows. This procedure will not change the established rotation (see illustration below).

Ampere readings must be taken at each roll. Three sets of readings will result.

If the abnormal reading stays with the same supply line, for example L1, then the supply is defective and the power company should be notified. If the abnormal reading stays with the same motor lead, for example "yellow", then the motor and/or its lead lines, including splices, is at fault and must be investigated and corrected.

Secure the connections.



7. TROUBLE SHOOTING CHART

In case of difficulties, refer to the chart to locate basic problems with the system. Once the problem is located, refer to specific sections in this manual for details.

CONDITION	PROBABLE CAUSE	REMEDY
PUMP WILL NOT RUN	1. Motor overload protector trip a. Incorrect control box b. Incorrect connections c. Faulty overload protector d. Low voltage e. Ambient temperature of control box or starter too high f. Pump bound by foreign matter	1. Overload will automatically reset. Investigate cause of overload. a. Check nameplate for HP and voltage. b. Check with wiring diagram (see motor control box wiring instruction). c. Replace protector if 3-wire motor. Replace motor if 2-wire motor. d. Check voltage at control box. e. Pull pump and examine.
	2. Blown fuse, broken or loose electric connections.	2. Check fuses, relays or heater elements for correct size capacitor and all electrical connections.
	3. Motor control box or starter not in proper position.	3. Make sure box is in upright position.
	4. Cable insulation damaged.	4. Locate and repair as per instructions.
	5. Splice may be open or grounded	5. Check resistance between cable leads with ohmmeter. If open or grounded, pull pump and q.
	6. Faulty pressure switch.	6. Repair or replace.
	7. Faulty liquid level control.	7. Check relay, wires and electrodes.
PUMP RUNS BUT NO WATER DELIVERED	1. Line check vavle backward	1. Reverse check valve
	2. Pump is air-bound.	2. Successively start and stop pump until water flows normally.
	3. Lift too high for pump.	3. Check with rating table.
	4. Intake strainer or impeller plugged, or pump in mud or sand.	4. Pull pump and clean, check well depth. Raise setting if necessary.
	5. Pump not submerged	5. Lower pump if permissible Check recovery of well.
	6. Well may contain excessive amounts of air or gas.	6. Start and stop pump several times. If this does not remedy conditions, pump may not be able to cooperate because of too much gas.
	7. Three-phase unit running backwards.	7. Reverse rotation.
REDUCED CAPACITY OR INSUFFICIENT TANK PRESSURE	1. Lift too high for pump.	1. Check rating
	2. Strainer or impellers partly plugged.	2. Pull pump and clean.
	3. Scaled or corroded discharge pipe or leaks anywhere in system.	3. Replace pipe and repair leaks.
	4. Well may contain excessive amounts of air or gas.	4. Start and stop pump several times. If this does not remedy conditions, pump may not be able to cooperate because of too much gas.
	5. Excess wear due to abrasives.	5. Replace worn parts.
	6. Three phase pump running backward.	6. Reverse rotation.
PRESSURE SWITCH DOES NOT CUT OUT	1. Incorrectly set.	1. Change settings.
	2. Switch opening plugged.	2. Clean openings or install new switch.
	3. Leaks anywhere in system.	3. Repair leaks.
	4. Three-phase unit running backward.	4. Reverse rotation.
PUMP STARTS TOO REQUENTLY	1. Water-logged tank.	1. a. Check tank for leaks. (Plug at top of tank may be leaking air.) b. Be sure drain and "Y" fittings are functioning properly. Check operation of snifter valve.
	2. Check valve leaking.	2. Replace check valve.
	3. Pressure switch out of adjustment.	3. Readjust to correct setting or replace.
	4. Leaks in service line.	4. Locate and correct.

SECTION 8 TECHNICAL DATA

Cable Selection

TABLE 1 Single Phase Motor Maximum Cable Length (Motor to Service Entrance)

Motor Rating		Cooper Wire Size								
Volts	H.P.	14	12	10	8	6	4	2	0	00
115	1/3	134	212	333	522	610	1240	1890	2550	
	1/2	100	159	249	390	608	930	1410	1910	
230	1/3	533	850	1350	2110	3290	5025	7650		
	1/2	404	641	1003	1575	2450	3750	5710		
	3/4	293	473	740	1161	1810	2760	4210	5680	
	1	248	392	617	968	1507	2300	3510	4730	5920
	1 1/2	205	326	510	801	1248	1920	2930	3950	4940
	2	180	286	449	703	1096	1675	2550	3440	4300
	3		229	359	563	877	1339	2041	2750	3440
	5			216	315	490	750	1142	1540	1925
	7 1/2				270	362	553	842	1136	1420
	10					250	425	650	875	1100

TABLE 2 Three Phase Motor Maximum Cable Length (Motor to Service Entrance)

Motor Rating		Cooper Wire Size										
Volts	H.P.	14	12	10	8	6	4	2	0	00	000	0000
200 V 60 HZ or 50 HZ	1 1/2	320	510	800	1260							
	2	250	390	610	960	1500						
	3	180	290	450	710	1110	1690					
	5			300	470	730	1110	1690				
	7 1/2				340	530	810	1230	1660			
	10				250	390	600	920	1240	1540		
	15					270	410	630	850	1060	1270	
	20						320	480	650	810	970	1150
	25							390	530	660	790	930
	30								430	540	640	750
230 V 60 HZ AND 220V 50 HZ	1 1/2	430	680	1070	1680							
	2	320	510	790	1250	1940						
	3	240	380	600	940	1470	2240					
	5		250	390	620	960	1470	2230				
	7 1/2			290	450	700	1070	1630	2200			
	10				340	520	800	1220	1640	2050		
	15					360	550	830	1130	1410	1680	
	20						420	640	860	1070	1280	1510
	25						340	520	700	870	1040	1230
	30							420	570	710	850	1000
460 V 60 HZ AND 360 V 50 HZ (Divide lengths by 1.4 for 360V 60 HZ)	1 1/2	1720										
	2	1280	2030									
	3	960	1530	2400								
	5	630	1000	1570	2470							
	7 1/2	460	730	1150	1800	2610						
	10		550	850	1340	2090	3190					
	15			590	920	1430	2190	3340				
	20				700	1100	1670	2550	3440			
	25				570	890	1360	2070	2600	3500		
	30					730	1110	1690	2280	2650	3400	
	40						850	1300	1750	2190	2610	3070
	50						680	1040	1400	1750	2090	2450
	60							870	1180	1470	1760	2070
	75								950	1190	1420	1670
	100									890	1060	1240

SECTION 8 Technical Data Cont...

TABLE 3

Single-phase 4" - 2 wire 60 HZ Submersible Motors
Motor Moldel No. Prefix 244

H.P.	Volts	Maximum Amps	Circuit Breaker or Fuse Size* - Amps	Winding Res. Ohms
1/3	115	8.9	25	1.5-1.9
1/3	230	4.4	15	6.0-7.4
1/2	115	11.9	30	1.0-1.3
1/2	230	5.9	15	4.2-5.2
3/4	230	8.0	20	2.7-3.4
1	230	9.6	25	2.2-2.8
1 1/2	230	13.1	35	1.5-1.9

* Use Type D fuses only.

TABLE 4

Single-phase 4" - 3 wire 60 HZ Submersible Motors
Motor Model No. Prefix 214 & 224

H.P.	Volts	Maximum Amps	Circuit Breaker or Fuse size* - Amps	Winding Res. Ohms
1/3	115	8.9	25	1.5-1.9
1/3	230	4.4	15	6.0-7.4
1/2	115	11.9	30	1.0-1.3
1/2	230	5.9	15	4.2-5.2
3/4	230	8.0	20	2.7-3.4
1	230	9.6	25	2.2-2.8
1 1/2	230	11.5	30	1.5-1.9
2	230	13.2	35	1.6-2.3
3	230	16.5	45	.9-1.5
5	230	27.5	80	.68-1.0

* Use Type D fues only.

TABLE 5

Single-phase 6" - 3 wire 60 HZ Submersible Motors
Motor Model No. Prefix 226

H.P.	Volts	Maximum Amps	Circuit Breaker or Fuse Size* - Amps	Winding Res. Ohms
5	230	29.5	80	.55-.68
7 1/2	230	40.0	100	.40-.50
10	230	52.0	150	.27-.33

* Use Type D fuses only.

TABLE 6

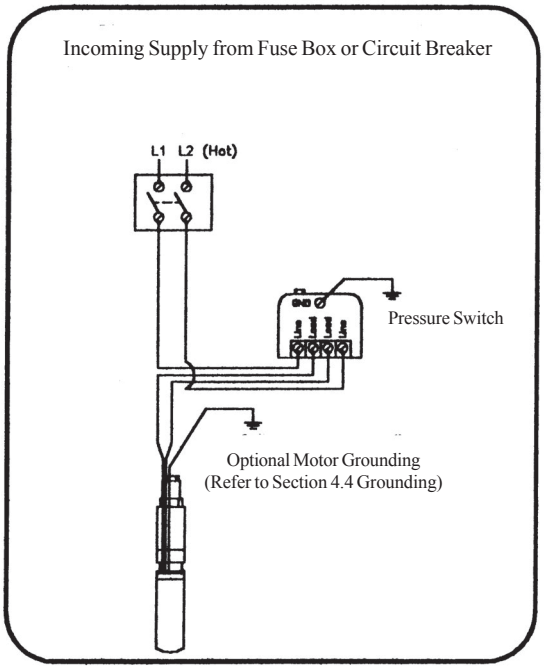
Three-phase 4" - 3 wire 60 HZ Submersible Motors
Motor Model No. Prefix 234

H.P.	Volts	Maximum Amps	Circuit Breaker or Fuse Size* - Amps	Winding Res. Ohms
1 1/2	200	7.3	20	2.4-3.4
1 1/2	230	6.3	20	3.2-4.1
1 1/2	460	3.1	15	11.3-15.0
1 1/2	575	2.5	15	15.1-26.0
2	200	9.4	25	1.9-2.4
2	230	8.2	20	2.4-3.0
2	460	4.1	15	9.7-12.0
2	575	3.3	15	13.6-18.9
3	200	13.1	35	1.3-1.7
3	230	11.4	30	1.8-2.2
3	460	5.7	15	7.0-8.7
3	575	4.6	15	11.0-13.6
5	200	20.0	50	.70-.94
5	230	17.4	45	.93-1.2
5	460	8.7	25	3.6-4.4
5	575	7.0	20	5.6-6.9
7 1/2	200	30.8	80	.55-.68
7 1/2	230	26.8	70	.76-.93
7 1/2	460	13.4	35	2.4-3.4
7 1/2	575	10.7	30	3.5-5.1
10	460	17.6	45	1.8-2.3
10	575	14.1	40	2.8-3.5

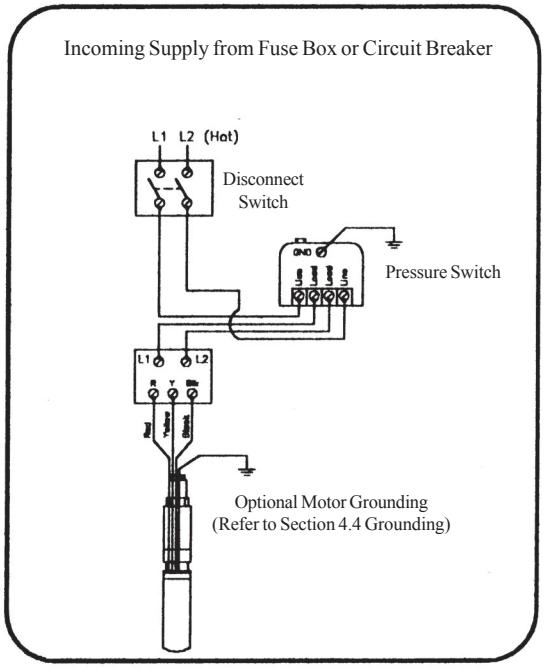
* Use Type D fuses only.

SECTION 9 WIRING DIAGRAMS

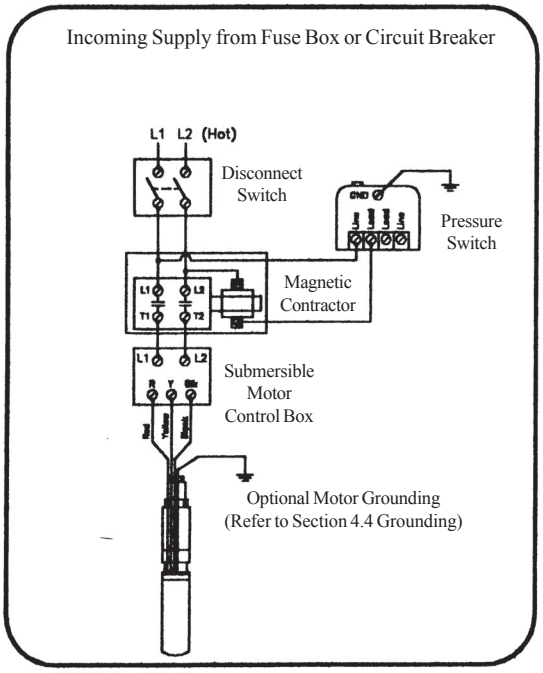
9.1 Single Phase, 2-Wire 1/3 - 1 1/2 HP Direct Connection to Adequately Sized Pressure Switch



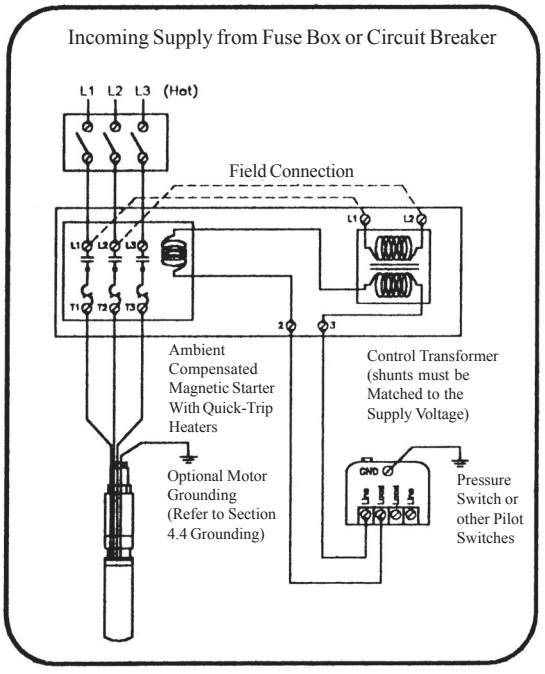
9.2 Single Phase, 3-Wire 1/3 - 5 HP Direct Connection to Adequately Sized Pressure Switch



9.3 Single Phase, 3-Wire With Magnetic Contactor



9.4 Three Phase Motor



SECTION 10 FLOW SLEEVE