STA-RITE

SUBMERSIBLE PUMP INSTALLATION AND SERVICE MANUAL

Applies to Equipment Manufactured After January 1, 1972

STA-RITE INDUSTRIES, INC.
a ***WICOR*** company
Delavan, Wisconsin

Los Angeles, California • Orlando, Florida
Atlanta, Georgia • Twin Falls, Idaho
Ledgewood, New Jersey • Oklahoma City, Oklahoma

Table of Contents

1. General Information

1.1 Introduction

Sta-Rite submersible pumps are designed to provide a long trouble-free life. Once a submersible unit has been properly installed, little or no attention is necessary.

1.2 Submersible Pump Unit

The pump unit consists of an electric motor coupled to a multi-stage centrifugal liquid end. The liquid end and motor together form the pump unit.

1.3 Liquid End

Each stage of the multi-stage centrifugal liquid end consists of an impeller and diffuser. As water moves through the liquid end, it picks up pressure in each stage.

All pumps contain water-lubricated components, therefore, the pump should never be run "dry".

Water enters the bottom of the liquid end through a screen which prevents the entrance of foreign material. The pumping of sand or other fine abrasives (which may pass through the screen) may damage the pump and should be avoided (see Sec. 3.11-Well Development).

1.4 Motor

The motors on submersible pumps are of a special design, engineered and constructed for this application.

Sta-Rite oil-filled motors use white mineral oil which is FDA approved (no. 121.1146). This oil acts as a dielectric and lubricant.

When using a water-filled motor, the water level in the motor should be checked prior to pump installation.

The motor is cooled by the flow of water in the well and should be installed approximately ten feet from the bottom of the well to avoid any build-up of mud or sand which might prevent proper cooling of the motor.

1.5 Control Box, Magnetic Starter or Pump Panel

Sta-Rite control boxes contain the electrical controls for single phase motors and must be sized to the pump horsepower.

A factory specified magnetic starter or pump panel must be used with any three phase submersible motor.

1.6 Cable

Submersible cable is either two or three conductor, with or without a ground conductor, water proof, heavily insulated cable made especially for this purpose. Use of other cable will void the warranty on the unit. For information on correct cable size, see Sec. 8 - Cable Selection Charts.

1.7 Pressure Tank Storage System

The pressure tank operates as a reservoir for the water system. As the tank fills with water, a cushion of air over the water is compressed, providing pressure for your water system.

Because the air in the pressure tank would gradually be absorbed by the water, devices to maintain this "air cushion" must be used. A Con-Aire™ tank uses a vinyl bladder; conventional tanks require an air charging system to maintain the "air cushion".

WARNING: FAILURE TO COMPLY WITH THE FOLLOWING INSTRUCTIONS FOR SAFE INSTALLATION AND OPERATION OF PRESSURE TANK STORAGE SYSTEMS MAY CAUSE TANK TO BLOW UP, RESULTING IN SERIOUS OR FATAL INJURY AND/OR PROPERTY DAMAGE.

Sta-Rite water storage tanks are designed for operation in cold well water systems with a maximum working pressure of 75 psi. IF A WATER SYSTEM HAS THE ABILITY TO EXCEED 75 PSI, A RELIEF VALVE OR HIGH PRESSURE CUT-OFF SWITCH MUST BE INSTALLED.

Relief valve must be capable of passing full pump capacity at 80 psi. Locate relief valve or high pressure cut-off switch in supply line between pump and tank (as close to tank as possible). Test relief valve once a month by lifting test handle and observing trickle of water from valve. If no water is observed, valve is defective and must be replaced.

PROTECT WATER SYSTEM FROM FREEZING WHICH MAY CAUSE PRESSURE CONTROLS TO BECOME INOPERATIVE AND CAUSE TANK TO BLOW UP.

Test water from well for safety before installing tank (check local health department for procedure).

Disconnect power to pump or control box before installing or servicing a water system.

Water system installations must comply with all applicable local codes and ordinances (electric, plumbing, sanitary, pump and well).

Remove air volume controls and other air charging devices when replacing a standard tank with a Con-Aire tank.

1.8 Definitions

Note: "Top of Well" also means "pitless adapter level".

"Service Inlet" also means "storage tank inlet".

Standing or Static Water Level - distance from top of well to natural water level when pump is not operating.

Drawdown Distance - distance water level drops while pump is operating.

Drawdown Level - standing water level plus drawdown.

Submergence - distance submersible pump intake screen is installed below drawdown level.

Elevation - vertical distance between top of well and service inlet.

Pump Setting - distance from top of well to pump inlet screen.

Pumping Level - distance from drawdown level to service inlet.

Service Pressure - pressure (in PSI) at service inlet.

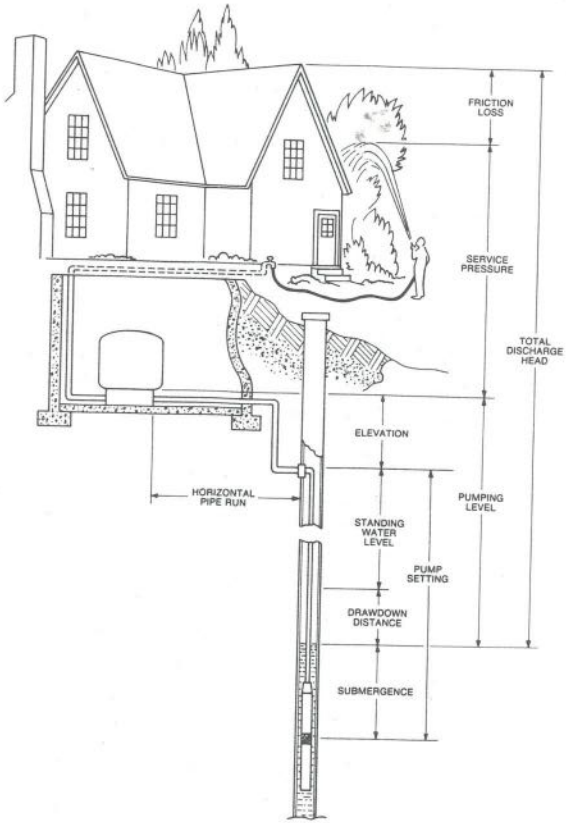
Friction Loss - loss of pressure due to friction of water flowing through pipe and fittings.

Total Discharge Head - discharge head (in feet) delivered when pump is operating at desired capacity.

Horizontal Pipe Run - horizontal distance between service inlet and well.

Note: PSI can be converted to equivalent feet of head by multiplying by 2.31.

DEFINITIONS



1.9 Special Installation Conditions

1. Restricted Motor Cooling

Installation where adequate cooling of the motor is restricted may cause abnormal temperature rise in the motor and pump failure. This is most likely to occur in sump or still water applications, in installations near the bottom of wells where gradual build-up of sand or sediment may insulate the motor, or in installations where water enters the well above the motor.

Inadequate cooling may usually be overcome by installing a shroud over the motor and pump intake, forcing the water pumped to flow past the motor (see figure). If well clearances prevent this, install a tube from the discharge of the pump down to the bottom of the motor (see figure). A minimum of one gallon per minute should be bypassed in this manner for 5 horsepower and smaller motors.

2. Sand in Well

Some wells will produce varying amounts of sand for an extended period of time. In these cases, the problem can often be overcome by installing a shroud, as above, except the shroud must be approximately twice as long as the pump (see figure). Care must be taken to insure that the shroud does not extend down into the sand at the bottom of the well.

3. Gaseous Water

Some wells have enough gas suspended in the water to gas lock a pump. This can usually be overcome by installing a shroud over the pump made of plastic well screen. It should be attached to the pump just below the pump intake and extend upward as far as practical (see figure).

Caution: This procedure may reduce the flow of cooling water past the motor and reduce the life of the motor.

4. Horizontal Installation

When a submersible pump is installed in a horizontal position, extra care must be taken to support the pump. There should be a minimum of three supports not more than 2 feet apart and the pump must be held in place to prevent movement caused by starting torque.

Note: Hitachi motors - Mount motor so that lead wires are in the 12 o'clock position when facing the motor shaft.

Submersible pumps should never be installed without adequate grounding in ponds, lakes, swimming pools, etc. where personal contact could result in electrical shock.

Do not hesitate to contact the factory for further information or assistance.

5. Low Production Well

In some installations, the pump will discharge water from the well faster than the well can supply, resulting in excessive drawdown. This exposes the pump inlet, allowing air to be pulled into the pump, usually resulting in air locking. When this occurs, it is usually necessary to set the pump lower in the well. If this cannot be done, the flow from the pump must be reduced to match the capacity of the well.

6. Corrosive Water

When corrosive conditions are anticipated, consult factory for recommendations or special materials.

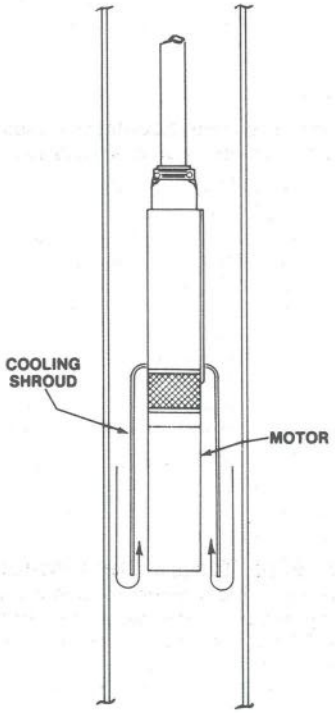
7. High Temperature Water

The Sta-Rite submersible pump is designed to pump potable water at temperatures up to 77° F. For applications where the unit will be pumping water at higher temperatures, consult the factory before making the

installation. Failure to do so will void the warranty.

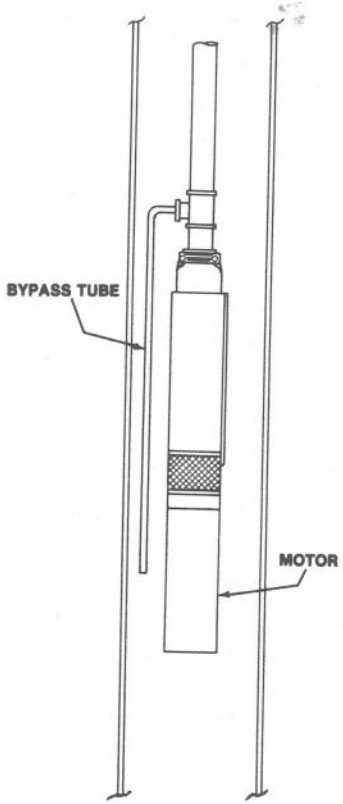
Restricted Motor Cooling

(When well clearances are not limited)

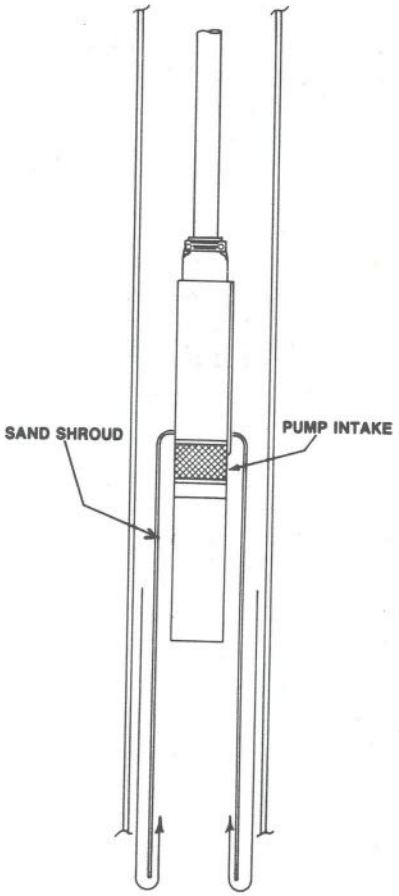


Restricted Motor Cooling

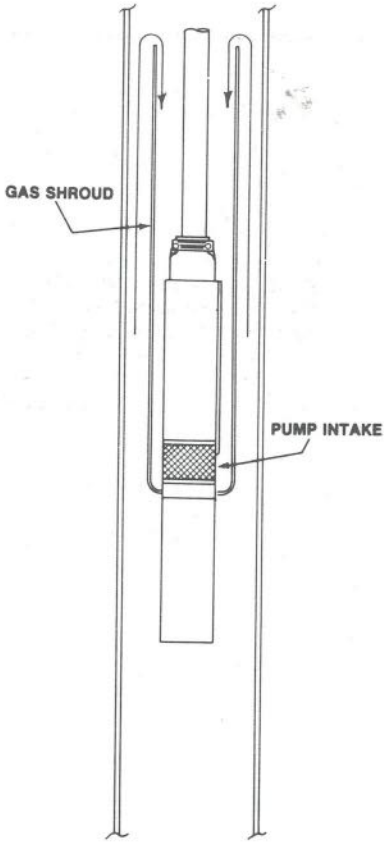
(When well clearances are limited)



Sand in Well



Gaseous Water



2. Instrument Instructions

2.1 Ohmmeter Instructions

The ohmmeter is an instrument used for measuring the electrical resistance of a circuit. The unit of measurement is called an ohm. The knob located at the bottom of the ohmmmeter is adjustable thru six ranges:

RX1 = Reading times 1
RX10 = Reading times 10
RX100 = Reading times 100
RX1000 = Reading times 1000
RX10K = Reading times 10,000
RX100K = Reading times 100,000

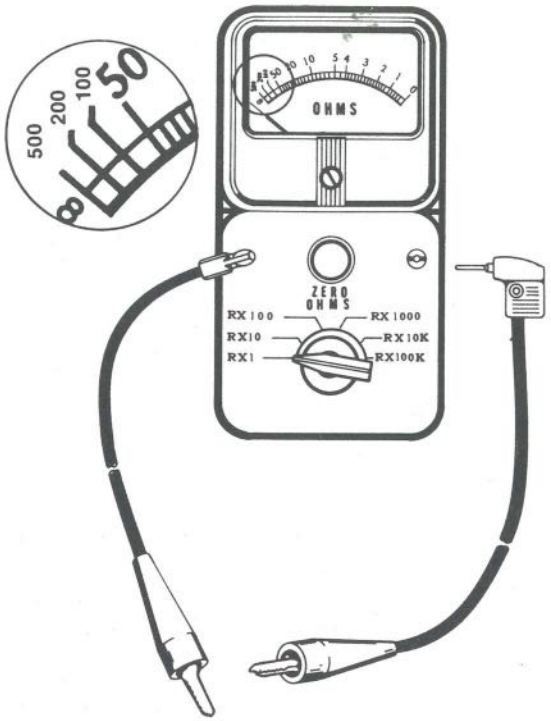
Ohmmeters that do not have the RX100K scale may not be adequate for checking insulation resistance.

The round center knob is used to adjust the instrument to "0" (zero resistance) after clipping the two ohmmeter leads together. This must be done every time the range is changed.

Note: All wires and clips must be clean and dry to assure accurate readings.

Caution: Use ohmmeter only with the power disconnected.

Ohmmeter

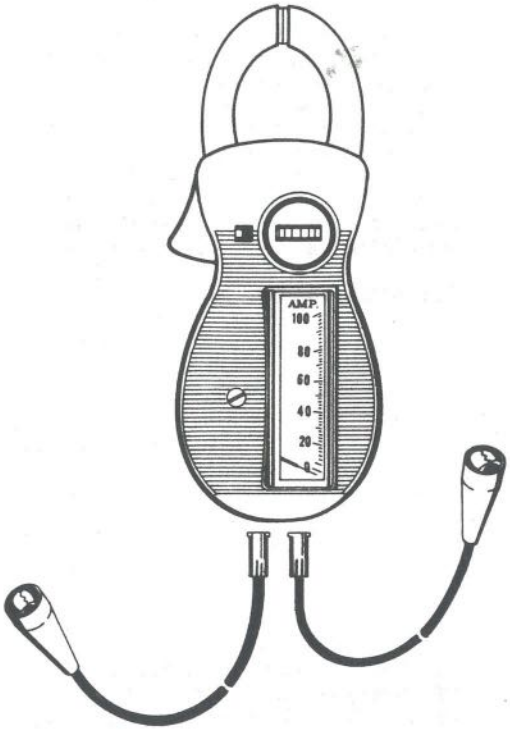


2.2 Amprobe Instructions

The amprobe is a tong-type, combination ammeter and voltmeter. When used as a voltmeter, the two leads are plugged into the bottom of the instrument. Start with the rotary scale on the highest volt range, if the reading is less than 150 volts, rotate the scale to the 150 volt range.

When used as an ammeter, the tongs are placed around the wire with the rotary scale on the highest amp range. If necessary, the scale is then rotated to a lower range to obtain an accurate reading.

Choose an amprobe that will measure the highest current of any motor you might check.



3. Installation Instructions

Note: Installation procedures may vary from state to state. Refer to your state water code for proper installation regulations.

3.1 Driller Well Preparation

The well should be bailed until all fine sand and foreign matter is removed. Although submersible pumps will handle a small amount of sand, an excessive amount will result in lower efficiency due to wear.

3.2 Pre-Installation Checks

Inspect the shipment, examine for damaged or broken parts. Check the number of items received with those shown on invoice. Any damage should be reported to the carrier or your dealer.

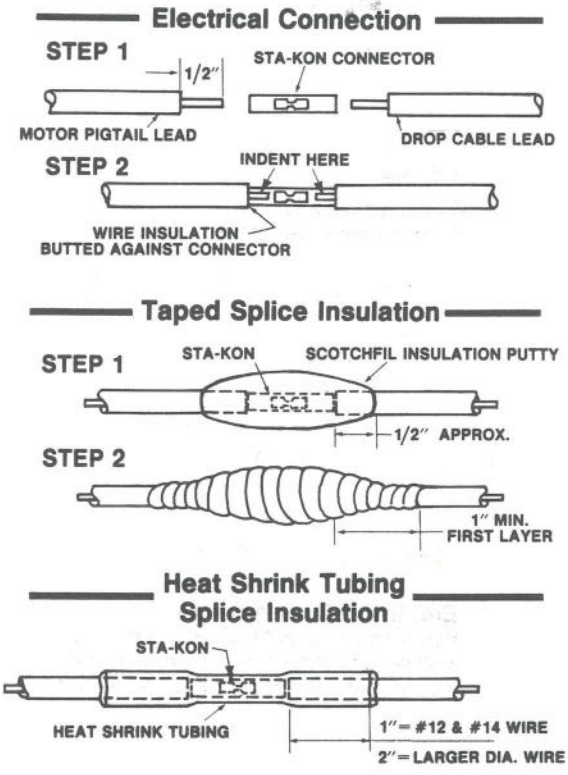
Check motor and control box nameplates to be sure they are in agreement regarding voltage, horsepower and phase. Check power supply for proper voltage and phase.

If the pump has a check valve, make sure the poppet is free.

3.3 Cable Splice

The cable splice must be made with extreme care. The motor pigtail leads should be cut off in a staggered manner, each lead approximately 2 inches longer than the next. Cut drop cable leads so that each lead matches up with the proper motor pigtail lead. It is essential on single phase motors that each drop cable lead be attached to a

motor pigtail lead of the same color. Trim insulation back from end of each lead and insert lead into Sta-Kon with insulation butted against Sta-Kon (see figure). If heat shrink tubing is being used, be sure to place tubing over wire before crimping both sides of Sta-Kon. At this point, use one of the following methods to complete the splice:



1. Scotchfill Insulation Putty and #33 Scotch Tape

Form a piece of Scotchfil insulation putty (approximately 1 inch x 1½ inches) tightly around each Sta-Kon and also overlapping the wire insulation. Wrap each wire and joint tightly with #33 Scotch Tape for a distance of about 1½ inches on both sides of Sta-Kon (see figure). Make four passes over each wire with each pass extending beyond the previous. The tape edge should be pressed down solidly. When wrapping tape always half lap to insure proper sealing.
Splice effectiveness will depend on care used in wrapping the tape as this is the only means of preventing the entrance of water to splice.

2. Heat Shrink Tubing

Center tubing over Sta-Kon. Using a propane torch (a match or lighter will not result in a good splice), heat tubing by slowly passing torch back and forth. When heat shrink tubing begins to deform, increase concentration of heat at center of tube (see figure). When center of heat shrink tubing collapses on wire, work heat out to each end until filler oozes out. Always keep torch moving, too much concentrated heat may damage tubing.

Check continuity of cable splices before installation; this can be done by measuring winding resistance. (see Section 5.3-Motor Resistance Test.)

3.4 Electrical Connections

Wiring to pump and control box must be installed and maintained in accordance with the National Electrical Code or your local code. If more information is needed, call your electrician or power company.

3.5 Grounding and Bonding

Permanently ground control box, magnetic starter, or pump panel in accordance with National Electrical Code Article 250 or your local code. It is recommended that a permanent ground connection be made to the unit using a conductor of appropriate size from a grounded lead in the service entrance. A metal underground water pipe at least 10 feet long or metal well casing also makes an acceptable ground electrode. Attach ground wire with a suitable fitting; do not use a hose clamp for this connection. If plastic pipe or insulated fittings are used, or well casing does not extend to pumping level, use ground electrode furnished by power company. Do not ground to a gas supply line. Do not connect to power supply until unit is permanently grounded. Connect ground wire to approved ground and then connect to terminal provided.

Pumps and pressure tank should be bonded to control box, magnetic starter, or pump panel with bonding conductors.

circuit conductors supplying the motor providing the circuit conductors conform to wiring data provided in this manual. (see Section 8 - Cable Selection Charts.)

3.6 Voltage Variation and Current Unbalance

Voltage variations should not exceed values given in Section 5.1 -Supply Voltage Test. Call power company if voltage is not within these limits.

Larger motors may require a reduced voltage starter. If a reduced voltage starter is used, the reduced voltage tap should be no lower than 80% of rated

voltage and starting time 3 seconds or less. Three phase voltage and current unbalance may cause tripping of overloads and premature motor failure if current unbalance is greater than 5%. (see Section 5.2-Motor Current Test.) If power company cannot guarantee proper degree of balance, next larger HP motor should be used.

3.7 Lightning Arresters

Many Sta-Rite motors come equipped with internal lightning arresters, however, if your pump is not lightning protected, use of a lightning arrester is recommended. The arrester may be installed indoors or outdoors on single and three phase power circuits. The arrester should be installed as close as possible to the pump motor on the incoming power line, ahead of the control box, magnetic starter or pump panel. See Section 7 - Installation Wiring Diagrams for proper installation wiring.

The arrester must be grounded with 10 AWG or larger, bare wire. The best ground is a metal discharge pipe or metal well casing. Attach ground wire with a suitable fitting; do not use a hose clamp for this connection. If plastic pipe or insulated fittings are used, or well casing does not extend to pumping level, ground wire should be connected to motor. The uninsulated ground wire should be buried in earth between arrestor and well and be as short as possible.

Conductors providing grounding for lightning arresters should not be run alongside supply conductors. If possible, grounding conductor should be run at a right angle to supply conductors until they are separated by at least 5 feet.

Note: If lightning arresters wired in control box are against your local electrical code,

contact your power company for correct wiring.

3.8 Thrust Plug Setting (6" Pumps and Larger)

When replacing a liquid end or motor on 6" and larger pumps, this procedure should be followed:

1. Before liquid end is assembled to motor, remove thrust plug from discharge connection by removing #10-32 machine screw and unscrewing thrust plug.

2. After liquid end and motor are assembled, lubricate thrust plug threads with Never-Sieze or waterproof grease and replace thrust plug.

3. Turn down thrust plug until it bottoms on pump shaft, then back off thrust plug as follows:

1/2 Turn	1-1/2 Turn	
75 Series	225 Series	700 Series
90 Series	325 Series	800 Series
190 Series	400 Series	950 Series
300 Series	500 Series	975 Series
	550 Series	1100 Series

4. Continue to back-off until one of the holes in thrust plug lines up with tapped hole in discharge connection (this will not exceed 1/4 turn more).

5. Secure thrust plug with #10-32 machine screw and lockwasher.

Note: Thrust plug can be turned using long-nosed pliers as spanner wrench.

3.9 Lowering Unit and Completing Installation

When lowering unit into well be careful not to scrape or nick the electrical cable. The cable should be taped or otherwise fastened to drop pipe approximately every ten feet. Do not use any clamping device that may cut the cable insulation.

A well seal should be installed at well top to prevent contamination. State and local codes should be consulted for specific regulations.

3.10 Rotation (Three Phase Only)

To make sure motor is running in the right direction, proceed as follows:

1. Connect motor leads to output terminals of magnetic starter pump panel. Close discharge valve (and keep closed during test).
2. Turn pump on and check water pressure.
3. Turn power off and reverse any two of the three leads.
4. Turn pump on and re-check water pressure. The connection that gives highest pressure is correct.

3.11 Well Development

Complete the following well development procedure before plumbing pump for automatic operation. Never start a pump at open discharge before following this procedure.

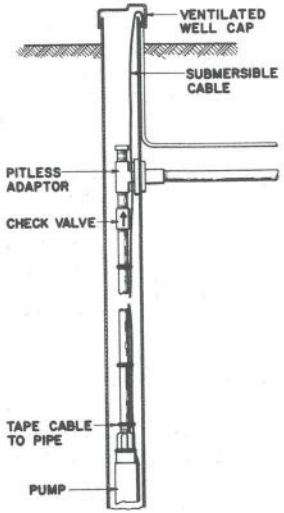
1. Make sure power is off. Connect motor leads and power supply to motor control box, magnetic starter, or pump panel. Do not start pump yet.

2. Close discharge valve and start pump. After about 10 seconds, open discharge valve one-third. With discharge valve set in this position, allow water to run until clear of all sand and silt. Check water by catching in a glass container and waiting while solids settle to the bottom.

3. When water completely clears, open valve to approximately two-thirds and again allow water to run until clear.

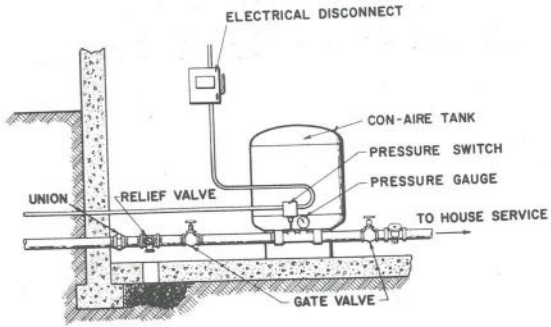
4. Finally, open valve completely and allow water to run until clear. This "well development" procedure will help increase the life of your pump and indicate whether or not the well is capable of supplying the pump's full capacity.

Submersible Installation with Con-Aire Tank

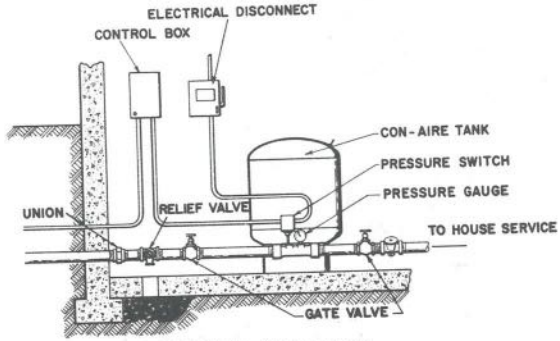


NOTICE

TWO WIRE MOTORS MANUFACTURED BEFORE JANUARY 1983. DO NOT HAVE AN OVERLOAD BUILT IN. FOR INSTALLATIONS USING THESE MOTORS THE OVERLOAD BOX SHOULD BE INSTALLED IN SERIES WITH PRESSURE SWITCH AND ELECTRICAL DISCONNECT.

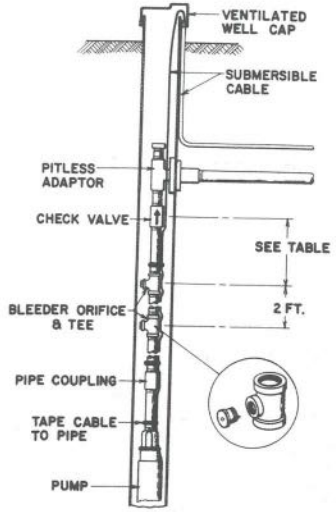


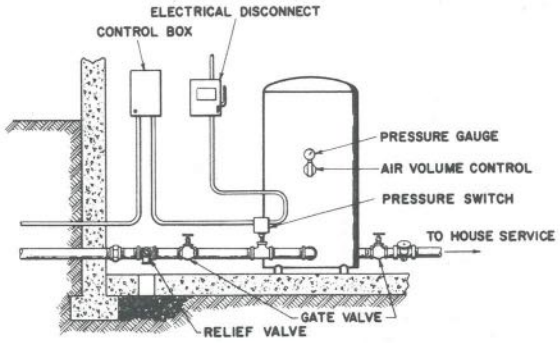
SUBMERSIBLE INSTALLATION
2 WIRE WITH CON-AIRE TANK



SUBMERSIBLE INSTALLATION
3 WIRE WITH CON-AIRE TANK

Submersible Installation with Conventional Tank





CHECK VALVE DISTANCE TO TOP BLEEDER ORIFICE	
TANK SIZE	DISTANCE
42 Gal.	4 Feet
82	6
120	10
220	10
315	20
525	30

4. Trouble Shooting

Experience proves that the majority of trouble with submersible pump units does not require pulling the pump from the well. Most troubles are electrical and occur above ground. Therefore, it is important to locate the trouble before pulling the pump from the well.

Most electrical problems are the result of defective start relays and start capacitors. These items should be the first parts replaced if electrical problems are indicated.

Electrical checks are not 100% conclusive, they will identify most defective parts but sometimes parts will check out OK but actually be defective.

4.1 Pump Will Not Run - Motor Overload Trips or Fuse Blows

PROBLEM	SOLUTION
1. Wrong size fuse.	1. See Section 5.2
2. High or low voltage.	2. See Section 5.1
3. Wrong control box.*	3. Replace if necessary.
4. Defective start capacitor.*	4. See Section 5.7
5. Defective run capacitor.*	5. See Section 5.7

6. Defective start relay.*	6. See Sections 5.8 and 5.9.
7. Broken or loose wire in control box.	7. Check visually, replace if necessary.
8. Corrosion on contacts between terminal strip & panel board.	8. Clean or replace terminal strip contacts.
9. Cable leads improperly connected to control box.	9. Check visually.
10. Control box in direct sunlight or overly heated room.	10. Move control box.
11. Defective pressure switch.	11. Check points visually, replace if necessary.
12. Worn pump (amps higher than normal).	12. See Section 5.2
13. Cable, splice or motor grounded, open or shorted.	13. See Sections 5.4, 5.5 and 5.6.
14. Pump stuck or binding.**	14. See Section 5.2 (Locked Rotor Amps).

4.2 Pump Will Not Run - Does Not Trip Overload or Blow Fuse

PROBLEM	SOLUTION
1. No voltage.	1. See Section 5.1
2. Pressure switch points bad.	2. Check visually, replace if necessary.
3. Open circuit in cable, splice or motor.	3. See Sections 5.3, 5.4 and 5.5.

4. Open circuit in control box.	4. Check for loose wire.
5. Defective magnetic contactor.	5. See Section 5.11.
6. Tripped low pressure switch.	6. Reset.

4.3 Pump Starts Too Frequently

PROBLEM	SOLUTION
1. Waterlogged tank:	1. Galvanized: Check tank for leaks. Check drain and bleeder orifices and snifter valve for proper operation.
	1. Captive Air: See Section 6.2
2. Check valve stuck open or leaking.	2. Replace if necessary.
3. Improper pressure switch setting or defective switch.	3. See Section 6.1
4. Leak in piping system.	4. Close shut-off valve between pressure switch and plumbing system. If pump shuts-off and stays off, the problem is in the plumbing. Check for leaky faucets, plumbing, toilets, etc. If pump continues to run, check supply plumbing for leaks.
5. Pressure tank improperly sized.	5. Install tank which allows a minimum of one minute of run time per cycle.
6. Improper precharge in captive air tank.	6. See Section 6.2

4.4 Pump Runs, But Little or No Water Delivered.

PROBLEM	SOLUTION
1. Cable leads improperly connected or loose in control box.	1. Check visually.
2. Pump not submerged.	1. Check water level in well.
3. Pump air-locked or gas-locked (motor draws idle amps).	3. See Section 5.2
4. Pressure switch defective.	4. See Section 5.1
5. Pump running backwards.	5. 3Ø - Reverse any two motor leads and restart pump. 1Ø - Check motor wiring at control box, red and black leads may be reversed.

6. Check valve installed backwards, stuck, or piping interferes with valve movement.	6. Replace if necessary.
7. Discharge pipe leaking.	7. Replace if necessary.
7. Pump intake screen plugged (motor draws reduced amps).	7. Pull pump and clean.
8. Worn pump.	8. Replace if necessary.
9. Broken pump shaft or coupling (motor draws idle amps).	9. Pull pump and inspect.

4.5 Pump Fails to Shut Off

PROBLEM	SOLUTION
1. Defective pressure switch or plugged pipe.	1. See Section 5.1 or check stand pipe to switch.
2. Cable lead improperly connected in control box.	2. Check visually.
3. Pump not submerged (motor draws idle amps).	3. Check water level in well.
4. Discharge pipe leaking or plugged with scale.	4. Replace if necessary.
5. Worn pump.	5. Replace if necessary.
6. Pump intake screen plugged (motor draws reduced amps).	6. Pull pump and clean.

4.6 Air or Milky Water From Faucet

PROBLEM	SOLUTION
1. Defective air volume control (conventional tank only).	1. Replace if necessary.
2. Weak water well - air being pumped with water.	2. Lower pump in well if possible or reduce discharge flow.
3. Gaseous water well.	3. See Section 1.9
4. Check valve leaking.	4. Replace if necessary.

4.7 Insufficient Tank Pressure

PROBLEM	SOLUTION
1. Improper pressure switch setting.	1. See Section 6.1
2. Worn pump.	2. Replace if necessary.
3. Leaks in piping system.	3. Replace if necessary.

***Note:** For pumps up to 1½ HP, a quick check for bad components or the wrong size control box is to pull the original board and put in one from a 1½ HP box known to be good. If the pump runs, the problem is in the control box; remove the 1½ HP panel board and start checking the original components. If the pump does not run, the problem is not in the control box.

****Note:** Often a sand-locked pump can be freed by running the pump backward and forward in one second intervals. Do this by reversing the red and black leads at the control box in one second intervals. This should be done about six times before the wires are reconnected to see if the pump will run. This procedure may be repeated twice.

If this does not work, try connecting an additional (identical) start capacitor temporarily. This will provide maximum starting torque from the motor. Connect one lead from the temporary capacitor to the black terminal of the control box; touch the other lead momentarily to the red terminal with the power turned on. Do not leave the temporary capacitor on line for more than one second under any conditions.

Caution: Capacitors may hold a charge even after a control box is turned off. Discharge capacitors by momentarily shorting across capacitor terminals with a screw driver blade or a jumper wire.

5. Check Out Electrical

5.1 Supply Voltage Test

1. Set amprobe on highest voltage scale, work back to get accurate reading (reading near mid-scale).
2. Measure voltage at motor terminals of control box, magnetic starter, or pump panel. On three wire single phase motors make measurement across terminals marked B and Y. On three phase motors measure across motor terminals two at a time. If no voltage exists, the problem could be tripped overload, defective supply wiring, defective pressure switch, or a blown fuse or circuit breaker. Isolate

problem by tracing back to service entrance with voltage measurements. Make voltage measurements at line terminals of control box, magnetic starter, or pump panel, at pressure switch, and at service entrance.

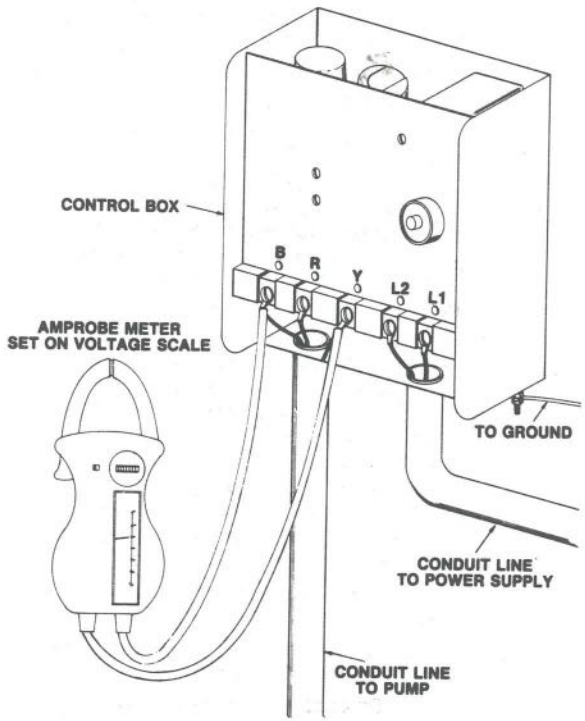
3. Compare measured voltage at motor terminals of control box, magnetic starter, or pump panel with supply voltage table. The local power company should be contacted if voltage reading is not within range shown in supply voltage table.

Note: Measure supply voltage with unit operating.

SUPPLY VOLTAGE TABLE (60 HERTZ)

		Allowable Range	
Volts	**Phase**	**Low**	**High**
115	1	104	126
200	1	180	220
230	1	207	253
200	3	180	220
230	3	207	253
460	3	414	506
575	3	518	632

Supply Voltage Test



Amprobe connections to motor terminals of capacitor run control box for measuring supply voltage.

Note: Induction run control boxes have a single terminal for connection of Y and L2.

5.2 Motor Current (Amperage) Test

1. Motor must be running.
2. Set Amprobe on highest amperage scale, work back to get accurate reading (reading near mid-scale).
3. Single phase three wire motor - place tongs around yellow wire.

   Single phase two wire motor - place tongs around either wire.

   Three phase motor - place tongs around each wire in turn.
4. Compare measured currents with motor current tables. When operating on extremely high (+10%) or low (-10%) voltage, max. load amps may be as much as 10% higher than those values listed.

Note: Three Phase Current Unbalance

Current unbalance, particularly in rural areas with heavy single phase loads, can cause premature motor failure - a result of reduced starting and breakdown torque, excessive and uneven heating, and excessive vibration.

Current and voltage unbalance are not directly related; a small voltage unbalance will sometimes cause a large current unbalance.

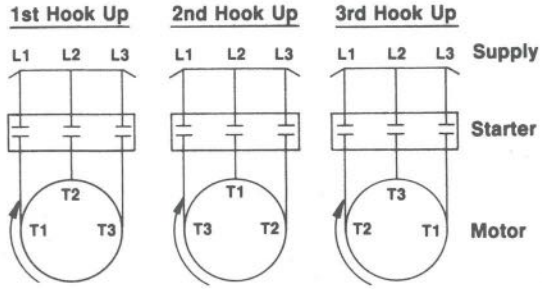
Current unbalance between legs should not exceed 5%.

The percent of current unbalance is defined and calculated as follows:

$$\text{Percent current unbalance} = \frac{\text{maximum current difference from average current}}{\text{average current}} \times 100$$

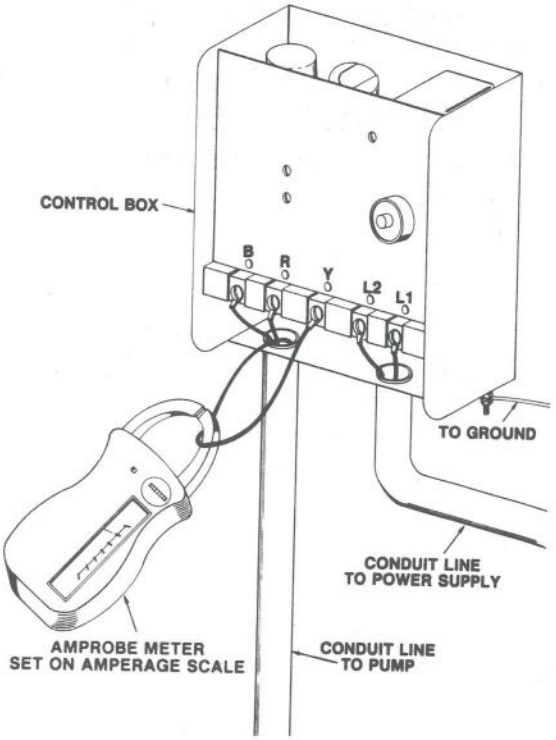
Current readings in amps should be checked on each leg using the three possible hookups shown in the illustration. The best hookup is the one that has the lowest percentage of unbalance.

To prevent changing motor rotation when taking these readings, the motor leads should be rolled across the starter terminals by always moving them in the same direction, as shown in the illustration.



Calculate the percentage of current unbalance for all three hook ups. Since loads on a transformer bank may vary during the day, readings should be taken at least twice - once during the day in what would be considered the normal load period and once in the evening during the usual peak load period. The installation should be connected for the lowest percentage of current unbalance - again, not to exceed 5%.

Motor Current (Amperage) Test



Amprobe connection to capacitor run control box for motor current (amperage) test.

Applicable to Equipment Manufactured After ***1/1/75***

Sta-Rite, Single Phase, 3-Wire Capacitor Run, 4 Inch, 60 Hertz

Motor Desc.		Amp Values - Yellow Lead		
HP	Volts	Idle Amps	Max.* Load Amps	Locked Rotor or Starting Amps
1/3	115	7.1	9.2	35.0
1/3	230	2.8	4.0	20.1
1/2	115	9.7	12.5	44.6
1/2	230	4.2	6.6	24.8
3/4	230	5.3	7.0	34.6
1	230	6.9	9.9	42.8
1-1/2	230	6.4	11.3	53.5
2	230	7.2	13.6	61.0
3	230	11.9	19.5	100.0
5	230	10.0	28.1	120.4

* Actual Max. Load Amps May Be 10% Less Than Listed

MOTOR CURRENT TABLES

Applicable to Equipment Manufactured After ***1/1/75***

Sta-Rite, Single Phase, 3-Wire, Capacitor Run, 4 Inch, 60 Hertz

Motor Desc.		Amp Values - Yellow Lead		
HP	Volts	Idle Amps	Max.* Load Amps	Locked Rotor or Starting Amps
1/3	115	4.1	8.0	33.0
1/3	230	1.2	3.3	18.5
1/2	115	6.4	9.9	38.8
1/2	230	2.7	4.5	23.5
3/4	230	4.4	6.7	26.8
1	230	5.6	8.7	36.0
1-1/2	230	6.7	11.0	48.5
2	230	8.7	14.3	58.0
3	230	12.0	19.0	85.0
5	230	9.5	29.5	118.0
7-1/2	230	25.8	43.0	153.0

* Actual Max. Load Amps May Be 10% Less Than Listed

MOTOR CURRENT TABLES

Applicable to Equipment Manufactured After ***1/1/75***

Sta-Rite, Single Phase, 3-Wire Induction Run, 4 Inch, 60 Hertz

Motor Desc.		Amp Values - Yellow Lead		
HP	Volts	Idle Amps	Max.* Load Amps	Locked Rotor or Starting Amps
1/3	115	7.5	10.7	33.5
1/3	230	3.7	5.3	18.4
1/2	115	8.7	13.8	39.1
1/2	230	4.9	7.6	24.5
3/4	230	6.4	9.0	32.8
1	230	8.0	11.8	42.7

Applicable to Equipment Manufactured After ***1/1/75***

Sta-Rite, Single Phase, 3-Wire Induction Run, 4 Inch, 60 Hertz

Motor Desc.		Amp Values - Yellow Lead		
HP	Volts	Idle Amps	Max.* Load Amps	Locked Rotor or Starting Amps
1/3	115	6.5	10.4	37.0
1/3	230	3.4	5.2	18.8
1/2	115	9.3	13.4	48.4
1/2	230	4.5	6.7	24.0
3/4	230	5.5	8.7	33.5
1	230	8.0	11.2	42.0

* Actual Max. Load Amps May Be 10% Less Than Listed

MOTOR CURRENT TABLES

Applicable to Equipment Manufactured After 8/1/85

Sta-Rite, Single Phase, 2-Wire 4 Inch, 60 Hertz

Motor Desc.		Amp Values - Yellow Lead		
HP	Volts	Idle Amps	Max. Load Amps	Locked Rotor or Starting Amps
1/3	115	7.5	9.7	33.5
1/3	230	3.7	5.0	18.4
1/2	115	8.7	12.8	39.1
1/2	230	4.9	7.2	24.5
3/4	230	6.4	8.3	32.8
1	230	8.0	11.0	42.7

Applicable to Equipment Manufactured After ***1/1/75***

Sta-Rite, Single Phase, 2-Wire 4 Inch, 60 Hertz

Motor Desc.		Amp Values - Any Lead		
HP	Volts	Idle Amps	Max.* Load Amps	Locked Rotor or Starting Amps
1/3	115	5.2	8.2	23.0
1/3	230	2.2	3.5	10.5
1/2	115	6.1	9.6	27.5
1/2	230	2.7	4.3	15.0
3/4	230	4.0	6.4	25.0
1	230	4.9	7.8	30.0

* Actual Max. Load Amps May Be 10% Less Than Listed

MOTOR CURRENT TABLES

Applicable to Equipment Manufactured After ***1/1/75***

Sta-Rite, 3 Phase, 4-Inch, 60 Hertz

Motor Desc.		Amp Values - Any Lead				
HP	Volts	Idle Amps	Max.** Load Amps	Locked Rotor or Starting Amp	Starter Size	Heater Code*
1-1/2	230	4.0	6.6	50.6	00	K42
1-1/2	200	4.1	7.7	56.3		K49
2	230	4.7	8.1	59.4	0	K49
2	200	6.0	9.0	68.1		K50
3	230	7.6	11.6	91.8	0	K54
3	460	3.7	5.9	44.7	0	K41
3	575	2.6	4.6	32.0		K41
3	200	8.0	13.1	101.2		K56
5	230	13.1	20.2	125.2	1	K63
5	460	6.5	10.1	62.7	0	K53
5	575	4.5	8.1	50.0		K43
5	200	13.8	23.2	144.0		K64

* Furnas Ambient Compensated

** Actual Max. Load Amps May Be 10% Less Than Listed

MOTOR CURRENT TABLES

Applicable to Equipment Manufactured After ***1/1/75***

Sta-Rite, 3 Phase, 60 Hertz

Motor Description			Amp Value - Any Lead		
Dia.	HP	Volts	Idle Amps	Max.* Load Amps	Locked Rotor or Starting Amps
4	3/4	230	4.1	4.8	25.0
4	3/4	460	2.0	2.4	12.5
4	3/4	575	1.2	1.9	10.0
4	1	230	5.2	6.2	32.0
4	1	460	2.6	3.1	16.0
4	1	575	1.5	2.4	12.1
4	1-1/2	230	4.8	7.0	39.5
4	1-1/2	460	2.4	3.5	19.8
4	1-1/2	575	1.7	2.7	15.5
4	2	230	6.4	8.7	45.0
4	2	460	3.2	4.3	22.5
4	2	575	2.0	3.2	16.6
4	3	230	8.6	13.0	69.0
4	3	460	4.3	6.5	34.5
4	3	575	3.3	5.2	27.9
4	5	230	14.0	20.8	96.0
4	5	460	7.0	10.4	48.0
4	5	575	5.2	8.3	38.3
6	7-1/2	230	6.8	27.0	118.0
6	7-1/2	460	3.4	13.4	59.2
6	7-1/2	575	2.8	10.7	47.5
6	10	230	7.5	35.8	139.0
6	10	460	3.7	18.0	69.9
6	10	575	3.8	14.4	56.0
6	15	230	14.6	52.2	250.0
6	15	460	7.3	26.0	125.0
6	15	575	6.5	20.8	104.0
6	20	230	20.2	68.2	336.0
6	20	460	10.1	34.1	168.0
6	20	575	8.6	27.3	148.0
6	30	230	29.0	104.0	504.0
6	30	460	14.6	52.2	252.0
6	30	575	13.2	41.7	208.0
6	40	460	20.5	68.3	338.0
6	40	575	17.2	54.6	298.0

* Actual Max. Load Amps May Be 10% Less Than Listed

Franklin, Single Phase, 3-Wire 4 Inch, 60 Hertz

Motor Desc.		Amp Values - Yellow Lead		
HP	Volts	Idle Amps	Max. Load Amps	Locked Rotor or Starting Amps
1/3	115	6.4	8.9	32.8
1/3	230	3.2	4.4	16.4
1/2	115	8.4	11.9	46.0
1/2	230	4.2	5.9	23.1
3/4	230	5.5	8.0	33.1
1	230	6.7	9.6	42.0
1-1/2	230	5.4	11.6	52.0
2	230	5.1	13.2	51.0
3	230	11.8	17.0	71.0
5	230	7.0	27.5	118.0

Franklin, Single Phase, 2-Wire 4 Inch, 60 Hertz

Motor Desc.		Amp Values - Any Lead		
HP	Volts	Idle Amps	Max. Load Amps	Locked Rotor or Starting Amps
1/3	115	6.4	8.9	48.4
1/3	230	3.2	4.4	24.2
1/2	115	8.4	11.9	62.4
1/2	230	4.2	5.9	31.2
3/4	230	5.5	8.0	40.2
1	230	6.7	9.6	46.0
1-1/2	230	5.8	13.1	56.8

Franklin, Three Phase, 60 Hertz

Dia.	HP	Volts	Idle Amps	Max. Load Amps	Locked Rated Amps	Starter Size	Heater Code
4	1-1/2	200	4.3	7.4	14	00	K43
4	1-1/2	230	3.7	6.4	34	00	K41
4	1-1/2	460	1.9	3.2	17	00	K29
4	2	200	5.2	9.3	39	0	K50
4	2	230	4.5	8.1	46	0	K43
4	2	460	2.3	4.1	23	00	K33
4	3	200	4.0	12.2	70	0	K54
4	3	230	6.8	10.6	61	0	K52
4	3	460	3.4	5.3	31	0	K37
4	5	200	11.5	20.0	120	1	K61
4	5	230	10.0	17.4	104	1	K61
4	5	460	5.0	8.7	52	0	K49
4	7-1/2	200	15.5	30.8	158	1	K68
4	7-1/2	230	13.5	26.8	143	1	K67
4	7-1/2	460	6.7	13.4	72	1	K55
4	10	460	5.4	10.7	57	1	K52
6	5	200	9.7	19.1	98.9	1	K60
6	5	230	8.4	16.6	86.0	1	K57
6	5	460	4.2	8.3	43.0	0	K43
6	7-1/2	200	13.3	28.3	149.5	1	K67
6	7-1/2	230	11.6	24.6	130.0	1	K63
6	7-1/2	460	5.8	12.3	65.0	1	K53
6	10	200	15.6	37.0	197.8	1-3/4	K72
6	10	230	13.8	32.2	172.0	1-3/4	K69
6	10	460	6.8	16.1	86.0	1	K57
6	15	200	23.9	54.5	306	2-1/2	K76
6	15	230	20.8	47.4	266	2	K74
6	15	460	10.4	23.7	133	1-3/4	K63
6	20	200	28.5	69.7	416.3	3	K77
6	20	230	24.8	60.6	362	2-1/2	K76
6	20	460	12.4	30.3	181	2	K69
6	25	200	35.0	86.3	552	3	K85
6	25	230	30.4	75.0	480	3	K78
6	25	460	15.2	82.8	240	2	K72
6	30	200	36.3	104.0	602.6	3-1/2	K87
6	30	230	31.6	90.4	524	3	K86
6	30	460	15.8	45.2	262	2-1/2	K73
6	40	460	24.2	62.0	397	3	K76
6	40	575	19.4	49.6	317.6	3	K73

(continued on next page)

Franklin, Three Phase, 60 Hertz

Dia.	HP	Volts	Idle Amps	Max. Load Amps	Locked Rated Amps	Starter Size	Heater Code
6	50	460	27.4	77.0	414	3	K78
6	50	575	21.9	61.6	331.2	3	K76
8	40	460	20.0	60.0	342	3	K76
8	40	575	11.0	48.0	274	3	K73
8	50	460	24.0	75.0	433	3	K78
8	50	575	14.0	60.0	346	3	K75
8	60	460	26.5	89.0	560	3-1/2	K85
8	60	575	21.2	71.2	448	3-1/2	K78
8	75	460	32.5	110.0	750	3-1/2	K87
8	75	575	26.0	88.0	600	3-1/2	K85

Applicable to Equipment Manufactured After ***12/1/82***

Hitachi, Single Phase, Capacitor Run, 6 Inch, 60 Hertz

Motor Desc.		Amp Values - Yellow Lead		
HP	Volts	Idle Amps	Max. Load Amps	Locked Rotor or Starting Amps
5	230	8.8	27.1	124
7-1/2	230	8.3	40.9	167
10	230	12.0	54.0	202
15	230	16.1	84.9	275

MOTOR CURRENT TABLES

Applicable to Equipment Manufactured After ***12/1/82***

Hitachi, 3 Phase, 60 Hertz

Dia.	HP	Volts	Idle Amps	Max. Load	Locked Rotor	Starter Size	Heater Code*
6	5	230	7.8	16.6	100	1	K58
6	5	460	3.9	8.3	50	1	K43
6	7-1/2	230	10.6	24.4	144	1	K64
6	7-1/2	460	5.3	12.2	72	1	K54
6	10	230	13.4	32.0	208	1-3/4	K68
6	10	460	6.7	16.0	104	1	K58
6	15	230	19.2	46.2	320	2	K74
6	15	460	9.6	23.1	160	1-3/4	K63
6	20	230	27.6	63.0	422	2-1/2	K76
6	20	460	13.8	31.5	211	2	K67
6	25	230	31.0	75.4	488	3	K78
6	25	460	15.5	37.7	244	2	K72
6	30	230	35.2	90.4	530	3	K86
6	30	460	17.6	45.2	265	2-1/2	K73
6	40	460	21.5	58.5	295 *	3	K75
6	50	460	31.0	75.4	488	3	K78
6	60	460	35.2	90.4	530	3-1/2	K86
8	40	460	24.3	61.0	380	3	K75
8	50	460	26.1	72.4	435	3	K77
8	60	460	30.7	88.0	510	3-1/2	K85
8	75	460	35.0	108	648	3-1/2	K88
8	100	460	43.1	140	763	4	K89
8	125	460	81.8	192	827	4-1/2	K29
8	150	460	60.9	216	850	4-1/2	K29
10	175	460	52.5	231	1100	6	K21
10	200	460	52.5	270	1100	6	K23
10	250	460	58.7	344	1340	6	K26
12	300	460	96.2	391	2140	6	K29

* Furnas Ambient Compensated General Purpose Starter.

5.3 Motor Resistance Test

1. Power supply must be turned off and motor leads disconnected from control box, magnetic starter, or pump panel.

2. Set ohmmeter to RX1 scale and zero meter (see Section 2.1).

3. Single phase three wire motor or three phase motor - attach ohmmeter leads to motor leads two at a time to obtain three resistance reading.

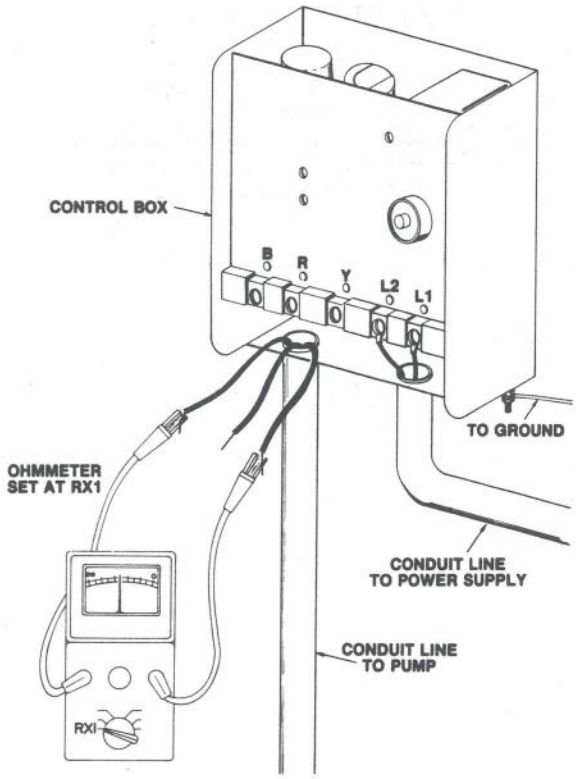
Single phase two wire motor - attach ohmmeter leads to motor leads to obtain resistance reading.

4. Compare measured resistances with motor resistance tables. Measured values should be within 10% of table values when motor is in well; with motor on bench values should be within 5%.

5. A high reading indicates an open circuit or poor connection in motor winding or motor cable; a low reading indicates a short circuit in motor or motor cable.

6. To help isolate location of a fault, readings may be taken at the control box, well head, and at the pump when a unit is installed or pulled.

Motor Resistance Test



Ohmmeter connections at location of control box for motor resistance test.

MOTOR RESISTANCE TABLES

Applicable to Equipment Manufactured After ***1/1/75***

Sta-Rite, Single Phase, 3-Wire Induction and Capacitor Run, 4 Inch, 60 Hertz

Motor Description		Motor Winding Resistance		
HP	Volts	Red to Yellow	Black to Yellow	Red to Black
1/3 1/3	115 230	6.5 6.5	1.5 5.7	8.0 12.2
1/2 1/2	115 230	5.3 5.3	1.0 4.0	6.3 9.3
3/4	230	5.4	3.0	8.3
1	230	3.7	2.1	5.8
1-1/2	230	6.8	2.1	8.9
2	230	3.4	1.4	4.8
3	230	2.5	.88	3.4
5	230	.83	.62	1.5

MOTOR RESISTANCE TABLES

Applicable to Equipment Manufactured After ***1/1/75***

Sta-Rite, Single Phase, 3-Wire Capacitor Run, 4 Inch, 60 Hertz

Motor Desc.		Motor Winding Resistance		
HP	Volts	Red to Yellow	Black to Yellow	Red to Black
1/3 1/3	115 230	4.0 6.2	1.9 8.1	5.9 14.3
1/2 1/2	115 230	4.3 6.7	1.4 5.5	5.7 12.2
3/4	230	4.1	3.7	7.8
1	230	4.7	2.7	7.4
1-1/2	230	5.5	2.0	7.5
2	230	3.0	1.5	4.5
3	230	2.2	1.2	3.4
5	230	.50	.61	1.11
7-1/2	230	.86	.38	1.24

MOTOR RESISTANCE TABLES

Applicable to Equipment Manufactured After ***1/1/75***

Sta-Rite, Single Phase, 3-Wire, Induction Run, 4 Inch, 60 Hertz

Motor Descrition		Motor Winding Resistance		
HP	Volts	Red to Yellow	Black to Yellow	Red to Black
1/3	115	6.7	1.4	8.1
1/3	230	6.7	5.7	12.4
1/2	115	5.5	1.0	6.5
1/2	230	5.4	3.9	9.3
3/4	230	5.6	2.9	8.5
1	230	3.7	2.1	5.8

Applicable to Equipment Manufactured After ***1/1/75***

Sta-Rite, Single Phase, 2-Wire 4 Inch, 60 Hertz

Motor Description		Motor Winding Resistance
HP	Volts	
1/3	115	1.5
1/3	230	8.1
1/2	115	1.2
1/2	230	5.5
3/4	230	3.3
1	230	2.7

MOTOR RESISTANCE TABLES

Applicable to Equipment Manufactured After ***1/1/75***

Sta-Rite, Single Phase, 2-Wire, 4 Inch, 60 Hertz

Motor Description		Motor Winding Resistance
HP	Volts	
1/3	115	1.9
1/3	230	7.9
1/2	115	1.4
1/2	230	5.5
3/4	230	3.0
1	230	2.7

Applicable to Equipment Manufactured After ***1/1/75***

Sta-Rite, 3 Phase, 4 Inch, 60 Hertz

Motor Description		Motor Winding Resistance
HP	Volts	
1-1/2	230	2.1
1-1/2	200	1.6
2	230	1.8
2	200	1.4
3	230	1.1
3	460	4.9
3	575	6.2
3	200	.90
5	230	.75
5	460	3.1
5	575	4.7
5	200	.53

MOTOR RESISTANCE TABLES

*Applicable to Equipment Manufactured After **1/1/75***

Sta-Rite, Three Phase, 60 Hertz

Motor Description			Motor Winding Resistance
Dia.	HP	Volts	
4	3/4	230	4.4
4	3/4	460	17.6
4	1	230	2.9
4	1	460	11.6
4	1-1/2	230	2.3
4	1-1/2	460	9.2
4	2	230	1.7
4	2	460	6.8
4	3	230	1.2
4	3	460	4.8
4	5	230	.60
4	5	460	2.4
4	5	575	3.5
6	7-1/2	230	.43
6	7-1/2	460	1.7
6	7-1/2	575	2.7
6	10	230	.32
6	10	460	1.3
6	10	575	2.0
6	15	230	.20
6	15	460	.81
6	15	575	1.3
6	20	230	1.5
6	20	460	.59
6	20	575	.92
6	30	230	.15
6	30	460	.60
6	30	575	.95
6	40	460	.50
6	40	575	.80

MOTOR RESISTANCE TABLES

Franklin, Single Phase, 3-Wire 4 Inch, 60 Hertz

Motor Desc.		Motor Winding Resistance		
HP	Volts	Red to Yellow	Black to Yellow	Red to Black
1/3	115	6.4	1.7	8.1
1/3	230	26.0	6.7	32.7
1/2	115	4.3	1.2	5.5
1/2	230	17.6	4.7	22.3
3/4	230	12.3	3.1	15.4
1	230	10.6	2.5	13.1
1-1/2	230	7.4	2.0	9.4
2	230	6.2	2.0	8.2
3	230	4.0	1.2	5.2
5	230	2.5	.9	3.4

Franklin, Single Phase, 2-Wire 4 Inch, 60 Hertz

Motor Description		Motor Winding Resistance
HP	Volts	
1/3	115	1.7
1/3	230	6.7
1/2	115	1.2
1/2	230	4.7
3/4	230	3.1
1	230	2.5
1-1/2	230	1.7

MOTOR RESISTANCE TABLES

Franklin, Three Phase, 60 Hertz

Dia.	HP	Volts	Motor Winding Resistance
4	1-1/2	200	2.9
4	1-1/2	230	3.7
4	1-1/2	460	13.2
4	2	200	2.1
4	2	230	2.7
4	2	460	10.9
4	3	200	1.5
4	3	230	2.0
4	3	460	7.9
4	5	200	.82
4	5	230	.98
4	5	460	4.0
4	7-1/2	200	.62
4	7-1/2	230	.85
4	7-1/2	460	2.90
4	10	460	2.05
6	5	200	.76
6	5	230	.99
6	5	460	3.9
6	7-1/2	200	.44
6	7-1/2	230	.64
6	7-1/2	460	2.4
6	10	200	.38
6	10	230	.49
6	10	460	4.4
6	15	200	.25
6	15	230	.30
6	15	460	1.19
6	20	200	.15
6	20	230	.22
6	20	460	.85
6	25	200	.12
6	25	230	.17
6	25	460	.66
6	30	200	.11
6	30	230	.14
6	30	460	.54

Continued on page 61.

MOTOR RESISTANCE TABLES

Franklin, Three Phase, 60 Hertz

Dia.	HP	Volts	Motor Winding Resistance
6	40	460	.36
6	40	575	.67
6	50	460	.29
6	50	575	.44
8	40	460	.27
8	40	575	.43
8	50	460	.20
8	50	575	.32
8	60	460	.16
8	60	575	.23
8	75	460	.12
8	75	575	.19

Continued from page 60.

Applicable to Equipment Manufactured After ***12/1/82***

Hitachi, Single Phase, Capacitor Run, 6 Inch, 60 Hertz

Motor Description		Motor Winding Resistance		
HP	Volts	Red to Yellow	Black to Yellow	Red to Black
5	230	2.05	.49	2.54
7-1/2	230	1.34	.38	1.27
10	230	1.00	.30	1.30
15	230	.67	.23	.84

MOTOR RESISTANCE TABLES

Applicable to Equipment Manufactured After ***12/1/82***

Hitachi, 3 Phase, 60 Hertz

Dia.	HP	Volts	Motor Winding Resistance
6	5	230	.78
6	5	460	2.98
6	7-1/2	230	.69
6	7-1/2	460	2.59
6	10	230	.44
6	10	460	1.61
6	15	230	.31
6	15	460	1.07
6	20	230	.24
6	20	460	.81
6	25	230	.21
6	25	460	.66
6	30	230	.16
6	30	460	.55
6	40	460	.36
6	50	460	.34
6	60	460	.29
8	40	460	.37
8	50	460	.33
8	60	460	.27
8	75	460	.22
8	100	460	.17
8	125	460	.13
8	150	460	.13
10	175	460	.11
10	200	460	.092
10	250	460	.077
12	300	460	.060

5.4 Insulation Resistance Test

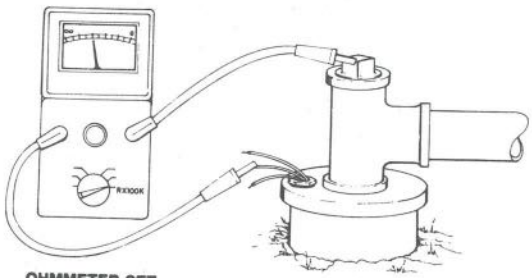
1. Power supply must be turned off and motor leads disconnected from control box, magnetic starter, or pump panel.
2. Set ohmmeter to RX100K scale and zero meter (see Section 2.1).
3. Attach one ohmmeter lead to a single motor lead and other lead to metal drop pipe or well casing. Check all motor leads.
4. To help isolate location of insulation defect, readings should be taken at the control box, at well head, and at the pump when a unit is installed or pulled.
5. The following are general guidelines for the insulation resistance test.

Resistance Reading (RX100K Scale)	Condition of Motor and and Leads
5 or greater	Good condition
.1 to 5	Slightly damaged but still service-able, pump need not be pulled.
.1 or less	Severely damaged, unit should be pulled and repairs made to motor or leads.

Note: An ohmmeter with a scale of at least RX100K must be used for this test.

Ohmmeter leads and ends of cable should be clean and dry when tests are made.

Insulation Resistance Test



OHMMETER SET AT RX100K

Ohmmeter connections at well head for insulation resistance test.

5.5 Cable and Splice Test

1. Submerge cable and splices in steel barrel of water with both ends out of water.
2. Set ohmmeter to RX100K scale and zero meter (see Section 2.1).
3. Attach one ohmmeter lead to steel barrel and other ohmmeter lead to a single cable lead. Check each cable lead.
4. If ohmmeter needle deflects to zero on any cable lead, pull cable slowly out of water. Section of cable just above water when reading returns to '∞' (infinite resistance) contains defect.
5. A cable defect or defective splice should be repaired with #33 Scotch electrical tape.

Note: A meter reading gradually increasing from "0" (zero resistance) to '∞' (infinite resistance) while cable is pulled from water indicates a defective cable which must be replaced.

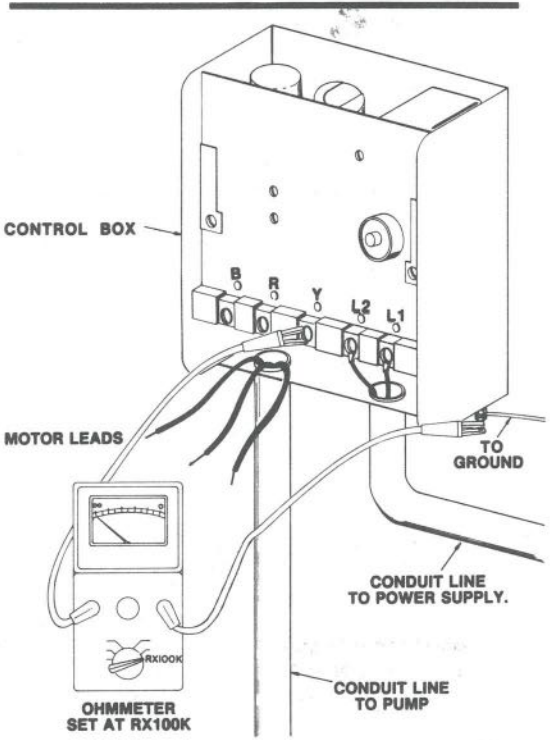
Cable and Splice Test

Ohmmeter connections for cable and splice test.

5.6 Control Box, Magnetic Starter, or Pump Panel Ground Test

1. Power supply must be turned off and motor leads disconnected.
2. Set ohmmeter to RX100K scale and zero meter. (see Section 2.1).
3. Attach one ohmmeter lead to ground lug; with other ohmmeter lead contact all exposed terminals or contacts within unit.
4. A reading of less than '∞' (infinite resistance) when any terminal or contact is tested indicates a ground.
5. Common causes of grounds are disconnected wires, defective wire insulation, and grounded capacitors.

Control Box, Magnetic Starter, or Pump Panel Ground Test



Ohmmeter connections to capacitor run control box for ground test.

5.7 Capacitor Test (Single Phase Motors Only)

Caution: Capacitors may hold a charge after a control box is turned off. Capacitors must be completely discharged before contacting capacitor terminals or connecting an ohmmeter across terminals. Discharge capacitors by momentarily shorting across terminals with a screw driver blade or jumper wire.

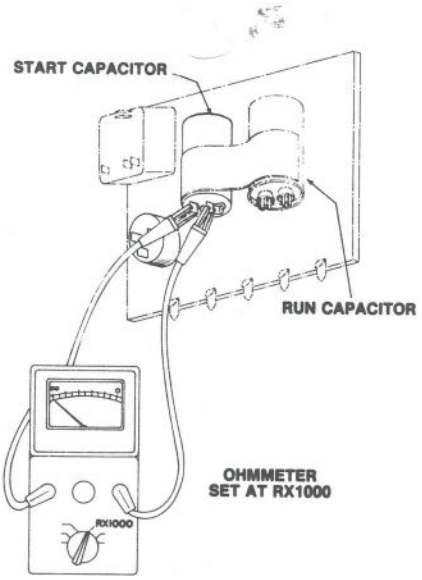
1. Power supply must be turned off.
2. Visually inspect all capacitors. Any capacitor with leakage, swelling, cracked case, or ruptured diaphram should be replaced.
3. Disconnect wires from one side of capacitor to be checked.
4. Set ohmmeter to RX1000 scale and zero meter (see Section 2.1).
5. Attach ohmmeter leads to the two capacitor terminals.
6. If a start capacitor is good, needle will deflect toward "0" (zero resistance) and then drift back slowly. If a run capacitor is good, needle will deflect toward "0" and then return quickly.
7. If either capacitor is bad, needle will not move or will swing toward "0" and stay there.
8. If a capacitor is checked a second time, it must be discharged before rechecking.

Note: This test is not conclusive, on occasion a bad capacitor will check out good according to this test. Substitution with a new capacitor is a good check for this.

Any replacement capacitor must have the correct voltage and capacitance rating.

Replacement of the start relay whenever a start capacitor is replaced is recommended.

Capacitor Test (Single Phase Motors Only)



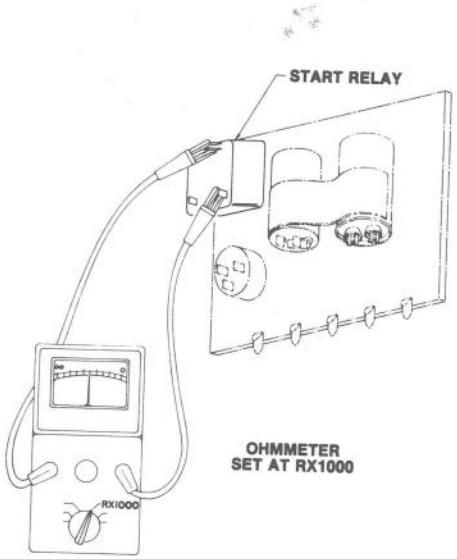
Ohmmeter connections to start capacitor of capacitor run control box for capacitor test.

NOTE: Induction run control boxes do not have a run capactior.

5.8 Start Relay Coil Test (Single Phase Motors Only)

1. Power supply must be turned off.
2. Disconnect lead from terminal 5 of relay.
3. Set ohmmeter to RX1000 scale and zero meter (see Section 2.1).
4. Attach ohmmeter leads to terminals 5 and 2 (or 6) of relay.
5. Compare measured resistance with start relay coil resistance table. If measured resistance is outside range given in table, relay must be replaced.

Start Relay Coil Test (Single Phase Motors Only)



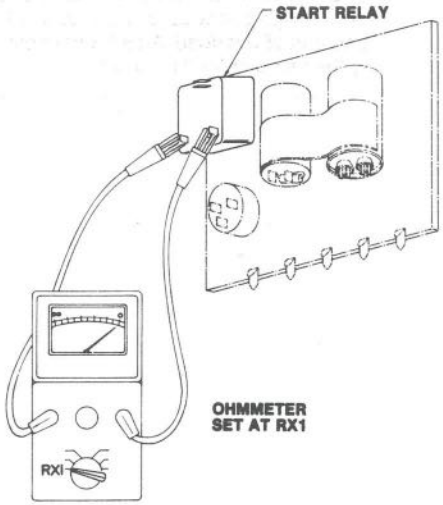
Ohmmeter connections to capacitor run control box for start relay coil test.

5.9 Start Relay Points Test (Single Phase Motors Only)

1. Power supply must be turned off.
2. Disconnect lead from terminal 1 of relay.
3. Set ohmmeter to RX1 scale and zero meter (see Section 2.1).
4. Attach ohmmeter leads to terminals 1 and 2 (or 6) of relay.
5. A needle deflection to "0" (zero resistance) indicates good relay points. If points are bad, relay must be replaced.

Note: This test will not detect welded contacts. A visual inspection with the relay cover removed will reveal the mechanical condition.

Start Relay Points Test (Single Phase Motors Only)



Ohmmeter connections to capacitor run control box for start relay points test.

5.10 Overload Protector Test (Single Phase Motors Only)

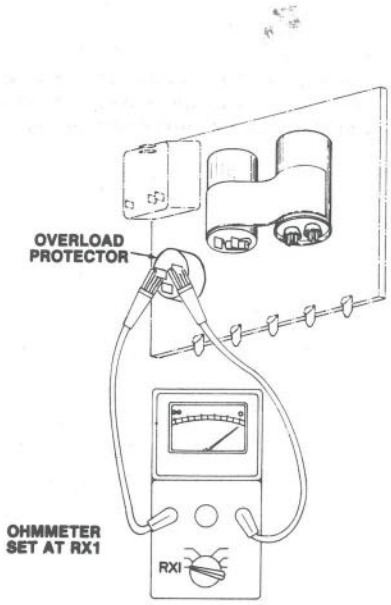
1. Power supply must be turned off.

2. Set ohmmeter to RX1 scale and zero meter (see Section 2.1).

3. Pushbutton reset type overload-disconnect lead from terminal 1 of overload and attach ohmmeter lead. Attach other ohmmeter lead first to one remaining overload terminal and then to other. Toggle switch type overload-disconnect lead from one end of overload. Attach ohmmeter leads to the two overload terminals.

4. If any reading is greater than 1 ohm, overload protector is bad and must be replaced.

Overload Protector Test (Single Phase Motors Only)

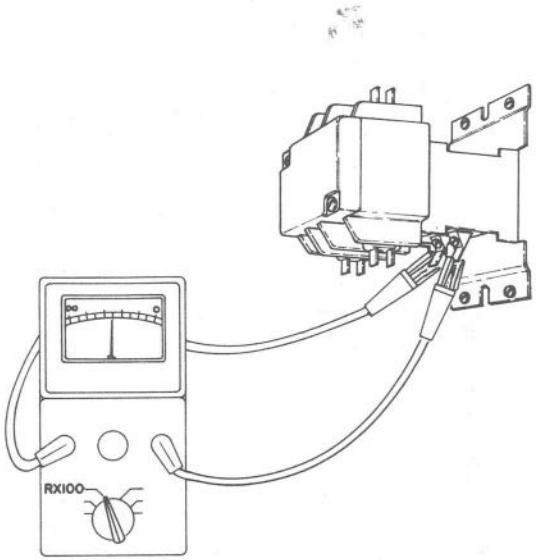


Ohmmeter connections to pushbutton reset type overload for overload protector test.

5.11 Contactor Coil Test (Some Larger Units Only)

1. Power supply must be turned off.
2. Disconnect one lead from contactor coil.
3. Set ohmmeter to RX100 scale and zero meter (see Section 2.1).
4. Attach ohmmeter leads to the two contactor coil terminals.
5. Compare measured resistance with contactor coil resistance table. If measured resistance is outside range given in table, coil or contactor must be replaced.

Contactor Coil Test (Some Larger Units Only)



OHMETER
SET AT RX100

Ohmeter connections to contactor coil terminals.

5.12 Control Box Tables

4" Capacitor Run Control Boxes

Control Box	Start Capacitor	Run Capacitor	Relay	Overload
CP4B01 (VIP4B01)	D	A	A	C
CP4B02(VIP4B02)	E	A	B	A
CP4B12(VIP4B12)	C	A	B	A
CP4C01(VIP4C01)	D	A	A	G
CP4C02(VIP4C02)	E	A	B	E
CP4C12(VIP4C12)	E	A	B	E
CP4D02(VIP4D02)	E	A	B	D
CP4D12(VIP4D12)	E	A	B	D
CP4E02(VIP4E02)	C	A	B	G
CP4E12(VIP4E12)	C	A	B	G
CP4F02(VIP4F02)	E	A	G	C
CP4F12(VIP4F12)	F	A	E	C
CP4G02(VIP4G02)	A	A	C	F
CP4G12(VIP4G12)	A	A	F	F
CP4H02(VIP4H02)	B	B (2)	C	B
CP4H12(VIP4H12)	B	B (2)	C	B
CP4J02-02	B	C (4)	D	Circuit Breaker J
CP4J02E	B	C (4)	D	Circuit Breaker J
CP4J12-02	G	C (4)	D	Circuit Breaker J
CP4J12A-02	G	C (4)	H	Circuit Breaker J

4" Induction Run Control Boxes

Control Box	Start Capacitor	Relay	Overload
IP4B01	D	A	C
IP4B02	E	B	H
IP4B12	C	B	H
IP4C01	D	A	G
IP4C02	E	B	E
IP4C12	E	B	E
IP4D02	E	B	D
IP4D12	E	B	D
IP4E02	C	B	G
IP4E12	C	B	G

6" Control Boxes

Control Box	Start Cap.	Run Cap.	Relay	2 Pole Contactor	Circuit Breaker
CP6J02-02	B (2)	D (2)	C	A	J
CP6J02H-02	I (1)	E (2)	I	—	I
CP6J02HC-02	I (1)	E (2)	I	A	I
CP6K02-02	H (2)	F (2)	J	B	K
CP6K02H-02	A (2)	G (2)	I	—	K
CP6K02HC-02	A (2)	G (2)	I	B	K
CP6K02M	A (1), I (1)	G (1), H (1)	K	—	K
CP6K02MC	A (1), I (1)	G (1), H (1)	K	B	K
CP6K12-02	H (2)	F (2)	J	C	L
CP6L02H-02	A (1), I (1)	H (2)	K	—	L
CP6L02HC-02	A (1), I (1)	H (2)	K	C	L
CP6L02M	I (2)	F (2)	K	—	L
CP6L02MC	I (2)	F (2)	K	C	L
CP6M02H	A (1), I (2)	I (3)	K	—	M
CP6M02HC	A (1), I (2)	I (3)	K	D	M

Relays		Coil Resistance Reading at 25° C (RX1000 Scale)
A. U18-810		1.3 - 1.6
B. U18-811	(G.E. J8V3)	2.1 - 2.7
	(G.E. J5V3)	3.2 - 4.0
C. U18-665		5.2 - 6.4
D. U18-1007		2.1 - 2.7
E. U18-1207		7.1 - 8.8
F. U18-1208		5.2 - 6.4
G. U18-1240		7.1 - 8.8
H. U18-1320		3.1 - 3.9
I. U18-325		5.2 - 6.4
J. U18-1202		5.2 - 6.4
K. U18-1327		8.7 - 10.7

Contactors	Coil Resistance Reading at 25° C (RX100 Scale)
A. P17-581	3.3 - 4.0
B. P17-664	2.2 - 2.7
C. P17-665	2.2 - 2.7
D. P17-691	.9 - 1.1

Start Capacitors

- **A.** U18-451
  124-149 microfarads, 330 VAC
- **B.** U18-452
  189-227 microfarads, 250 VAC
- **C.** U18-730
  108-130 microfarads, 250 VAC
- **D.** U18-812
  130-156 microfarads, 125 VAC
- **E.** U18-881
  88-108 microfarads, 250 VAC
- **F.** U18-1210
  130-156 microfarads, 250 VAC
- **G.** U18-1211
  243-292 microfarads, 220 VAC
- **H.** U18-1283
  270-324 microfarads, 220-250 VAC
- **I.** U18-1325
  189-227 microfarads, 330 VAC

Run Capacitors

- **A.** U18-733
  17.5 microfarads, 370 VAC
- **B.** U18-1383
  25 microfarads, 370 VAC
- **C.** U18-1008
  40 microfarads, 330 VAC
- **D.** U18-1273
  30 microfarads, 370 VAC
- **E.** U18-1324
  15 microfarads, 440 VAC
- **F.** U18-1203
  35 microfarads, 370 VAC
- **G.** U18-1322
  20 microfarads, 440 VAC
- **H.** U18-1326
  25 microfarads, 440 VAC
- **I.** U18-1368
  25 microfarads, 440 VAC

Overloads	Klixon Part Number
A. U18-453	MHC-1147
B. U18-455	CED-8945
C. U18-461	MHC-1133
D. U18-462	MHC-1129
E. U18-465	MHC-1132
F. U18-466	CET-38ER-7
G. U18-729	MHC-1156
H. U18-463	MHC-1130

Circuit Breakers	Amps	Heinemann Part Number
I. U17-703	30	CFI-G3-U-30-240-1
J. U17-704	35	CFI-G3-U-35-240-1
K. U17-705	50	CFI-G3-U-50-240-1
L. U17-706	60	CFI-G3-U-60-240-1
M. U17-708	93	CFI-G3-U-93-240-1

Magnetic Starter Heater Selection Chart

To insure protection of Sta-Rite submersible pumps and complete warranty coverage of the installation, use only magnetic starters with overload protection (heaters) as recommended in table below. Three phase motors must have 3 leg protection.

The following table applies to Industrial/ Agricultural submersible pumps shown on Price List 2-9.1 (dated August 17, 1981) and Price List S2063H (dated August 17, 1981). The information for 6", 8" 10", and 12" motors applies to water lubricated motors ("H" suffix).

MOTOR RATING						General Electric	General Electric	Furnas	Square D	Allen Bradley
						MAGNETIC STARTER TYPE				
						CR154[1]	CR206	Class 14	Class 8536	Bulletin 709
						OVERLOAD RELAY TYPE				
						Amb. Comp & Quick Trip CR124	Amb. Comp & Quick Trip CR124	Amb. Comp & Quick Trip Class 48	Quick Trip	Quick Trip Bulletin 815
						OVERLOAD HEATER ELEMENTS—3 REQUIRED				
MOTOR SIZE (MIN. WELL)	HP	Volts	Ø	Max. Load Amps	NEMA STARTER SIZE[4]	CR123L	CR123L	Type K	FB	Type J
4"	1½	230	3	6.6	00	6.8A		K42	FB8.6[2]	J23
4"	2	230	3	8.1	0	9.1A		K49	FB10.6	J25
4"	3 3	230 460	3 3	11.6 5.8	0 0	12.2B 6.8A		K54 K39	FB16.4 FB7.8	J29 J21
4"	5 5	230 460	3 3	20.2 10.1	1 0	22.0B 11.1B		K63 K53	FB28.3 FB13.9	J35 J27
6"	5 5	230 460	3 3	16.4 8.2	1 0	18.1B 9.1A	USE	K60 K49	FB23-6 FB11.2	J32 J25
6"	7½ 7½	230 460	3 3	22.7 11.4	1 1	24.1B 12.2B	IDENTICAL HEATERS	K64 K54	FB32.6 FB16.4	J35 J28
6"	10 10	230 460	3 3	29.8 14.9	2 (1¾) 1	32.2B 16.5B	AS SPECIFIED	K70 K58	FB38.3 FB21.1	J37 J31
6"	15 15	230 460	3 3	44.7 22.4	2 2 (1¾)	46.4B 24.1B	FOR CR154	K75 K64	FB55.5 FB29.6	J41 J35
6"	20 20	230 460	3 3	59.0 29.5	3 (2½) 2	62.2B 32.2B	STARTERS	K78 K69	FB60[3] FB38.3	J44 J37
6"	25 25	230 460	3 3	73.2 36.6	3 2	78.7B 39.0B		K83 K72	FB77[3] FB46	J46 J39
6"	30 30	230 460	3 3	85.3 42.7	3 3 (2½)	95.0B 46.4B		K87 K74	FB84[3] FB46[3]	J70 J41
6"	40	460	3	57.4	3	59.3B		K77	FB60[3]	J43
6"	50	460	3	71.0	3	78.7B		K83	FB69[3]	J45

(continued on next page)

MOTOR RATING						General Electric	General Electric	Furnas	Square D	Allen Bradley
							MAGNETIC STARTER TYPE			
						CR154[1]	CR206	Class 14	Class 8536	Bulletin 709
							OVERLOAD RELAY TYPE			
MOTOR SIZE (MIN. WELL)	HP	Volts	Ø	Max. Load Amps	NEMA STARTER SIZE[4]	Amb. Comp & Quick Trip CR124	Amb. Comp & Quick Trip CR124	Amb. Comp & Quick Trip Class 48	Quick Trip	Quick Trip Bulletin 815
							OVERLOAD HEATER ELEMENTS—3 REQUIRED			
						CR123L	CR123L	Type K	FB	Type J
6"	60	460	3	85.4	4 (3½)	95.0B	USE	K87	FB69[3]	J46
8"	40	460	3	61.8	3	62.2B	IDENTICAL HEATERS	K77	FB63.5[3]	J44
8"	50	460	3	76.9	3	78.7B		K85	FB77[3]	J46
8"	60	460	3	89.4	4 (3½)	95.0B	AS SPECIFIED	K87	FB77[3]	J70
8"	75	460	3	113.9	4 (3½)	107C		K89	FB84	J73
8"	100	460	3	147.7	4	155C	FOR CR154	K92	FB115	J75
10"	125	460	3	173.6	5 (4½)	9.10A	STARTERS	K27		J14
10"	150	460	3	208.6	5 (4½)	11.1B		K29		J16
12"	175	460	3	247.0	5	13.5B		K33		
12"	200	460	3	271.0	5	14.7B		K33		
12"	250	460	3	345.0	6	3.10A	CR286H	K28		

[1] General Electric magnetic starters are "definite purpose" (current rated), all other magnetic starters shown above are "general purpose" (HP rated).

[2] Must use Square D size "0" starter in place of size "00" indicated.

[3] For Square D starter sizes 3 and 4 specify "Form Y81".

[4] Furnas fractional size starters are shown within parenthesis.

This table is for general cross reference only. Amperage values are different for each brand of motor. Consult motor manufacturer for detailed information.

6. Check Out Hydraulic

6.1 Pressure Switch

Turn range nut down for higher cut-in pressure or up for lower pressure. Check switch operation after re-setting.

Caution: To avoid damage, do not exceed maximum allowable system pressure or maximum switch HP capability.

6.2 Con-Aire™ Pressure Tank

Set air pre-charge as follows:

1. Shut off power supply to pump and drain water system to zero pressure.
2. Set air pre-charge in tank to 2 PSI less than cut-in pressure of pressure switch.

Example: If pressure switch setting is 40-60 PSI, tank pre-charge should be 38 PSI.

If water is at pre-charge valve, replace bladder.

Caution: Do not exceed 75 PSI working pressure limit of Con-Aire™ tank.

Reduce tank pressure to zero PSI before removing any part of tank.

Note: To prevent build up of sand in tank and premature bladder failure, do not install tank in a horizontal position.

WARNING: FAILURE TO COMPLY WITH THE FOLLOWING INSTRUCTIONS FOR SAFE INSTALLATION AND OPERATION OF PRESSURE TANK STORAGE SYSTEMS MAY CAUSE TANK TO BLOW UP, RESULTING IN SERIOUS OR FATAL INJURY AND/OR PROPERTY DAMAGE.

Sta-Rite water storage tanks are designed for operation in cold well water systems with a maximum working pressure of 75 psi. IF A WATER SYSTEM HAS THE ABILITY TO EXCEED 75 PSI, A RELIEF VALVE OR HIGH PRESSURE CUT-OFF SWITCH MUST BE INSTALLED.

Relief valve must be capable of passing full pump capacity at 80 psi. Locate relief valve or high pressure cut-off switch in supply line between pump and tank (as close to tank as possible). Test relief valve once a month by lifting test handle and observing trickle of water from valve. If no water is observed, valve is defective and must be replaced.

PROTECT WATER SYSTEM FROM FREEZING WHICH MAY CAUSE PRESSURE CONTROLS TO BECOME INOPERATIVE AND CAUSE TANK TO BLOW UP.

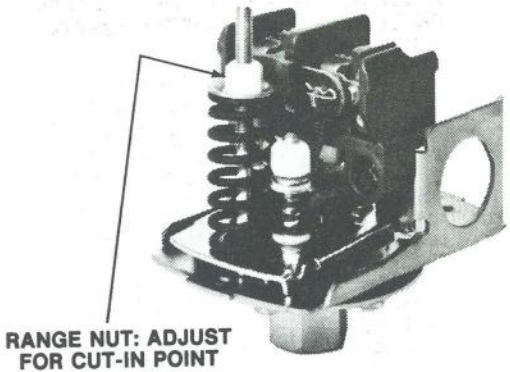
Test water from well for safety before installing tank (check local health department for procedure).

Disconnect power to pump or control box before installing or servicing a water system.

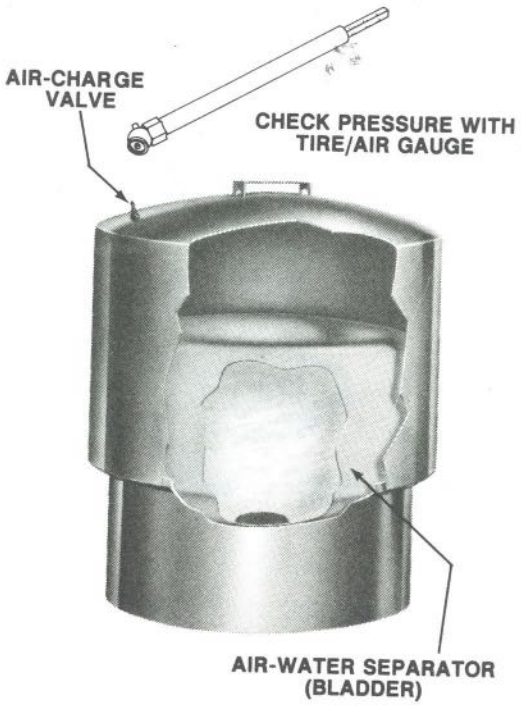
Water system installations must comply with all applicable local codes and ordinances (electric, plumbing, sanitary, pump and well).

Remove air volume controls and other air charging devices when replacing a standard tank with a Con-Aire tank.

Pressure Switch

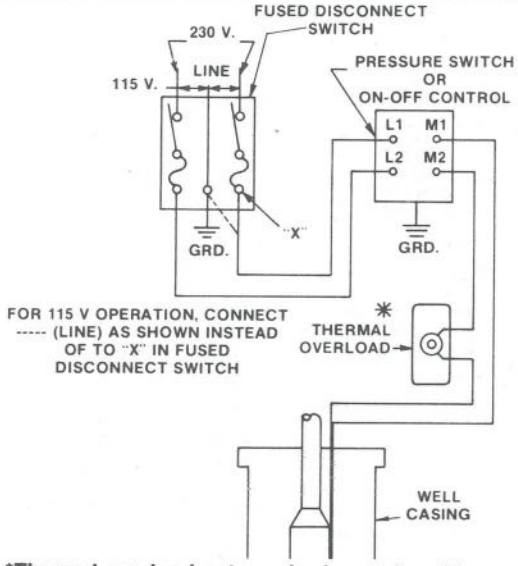


Con-Aire™ Pressure Tank



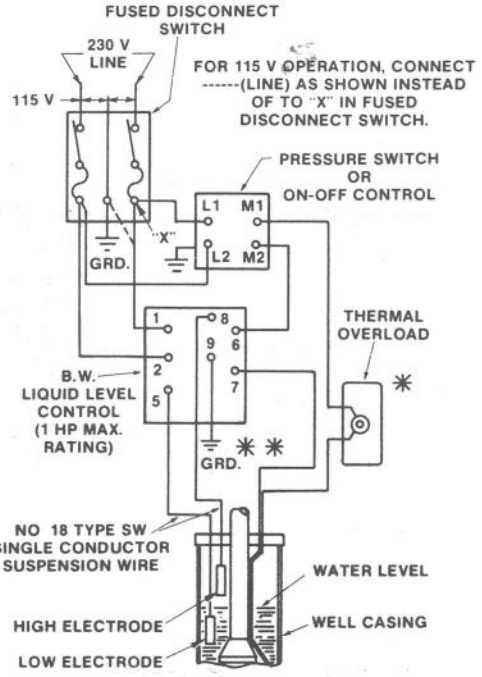
7. Installation Wiring Diagrams

INSTALLATION WIRING DIAGRAM
Single Phase, 2-Wire
1/3 thru 1 HP, w/Pressure Switch



***Thermal overload not required on units with built-in overload.**

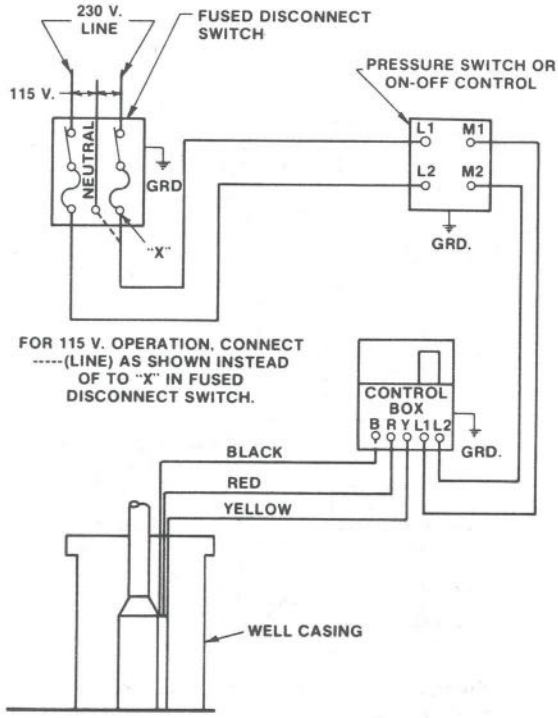
INSTALLATION WIRING DIAGRAM
Single Phase, 2-Wire
1/3 thru 1 HP, w/Pressure Switch
w/Level Control



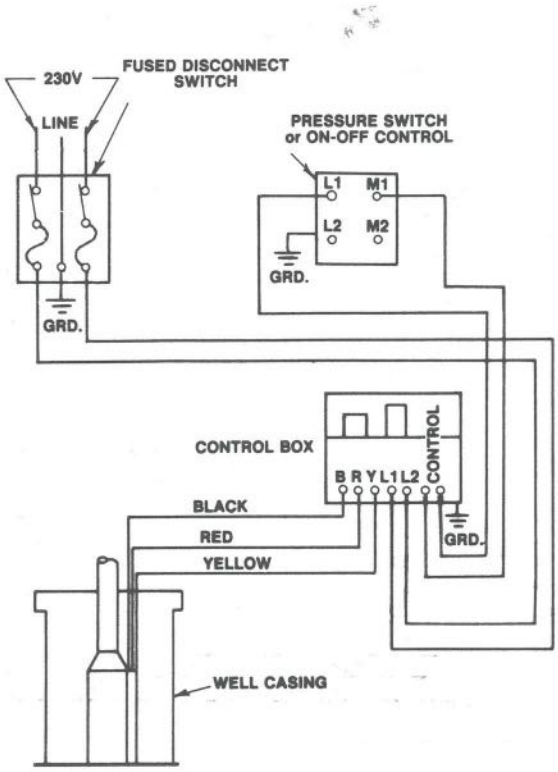
*Thermal overload not required on units with built-in overload.

**Liquid level control ground connection should be made to metal drop pipe or metal well casing.

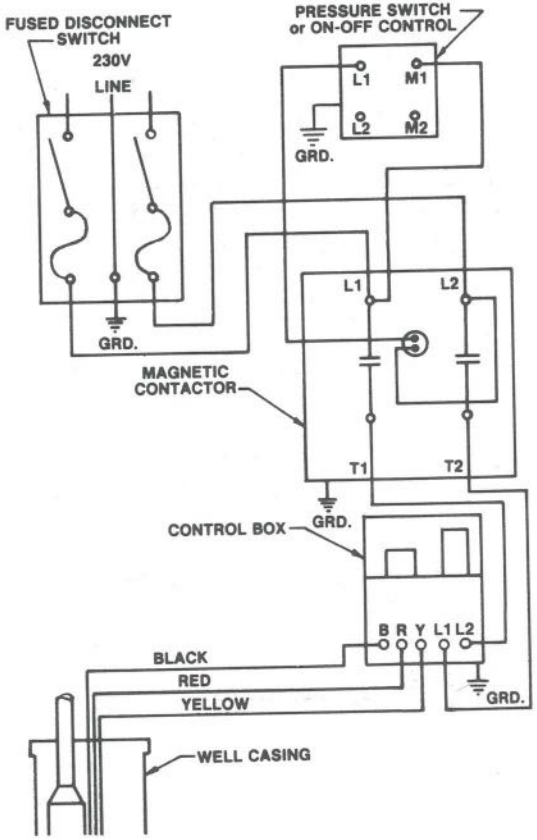
INSTALLATION WIRING DIAGRAM
Single Phase, 3-Wire, 1/3 thru 3 HP
w/Pressure Switch
(switch must be adequately rated)



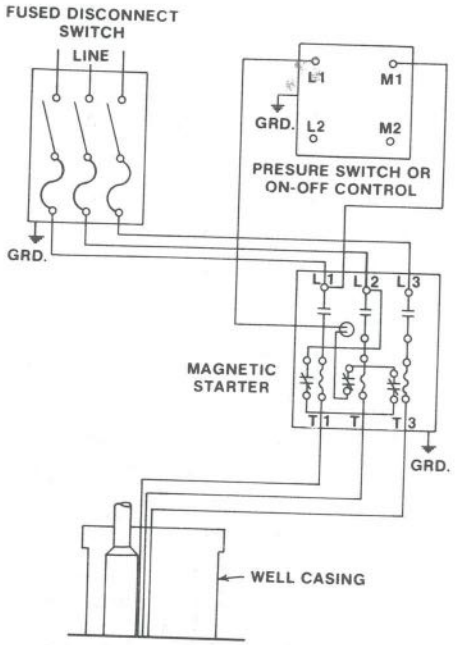
INSTALLATION WIRING DIAGRAM
Single Phase, 3 Wire
5 thru 15HP, w/Pressure Switch
w/Built-in Contactor



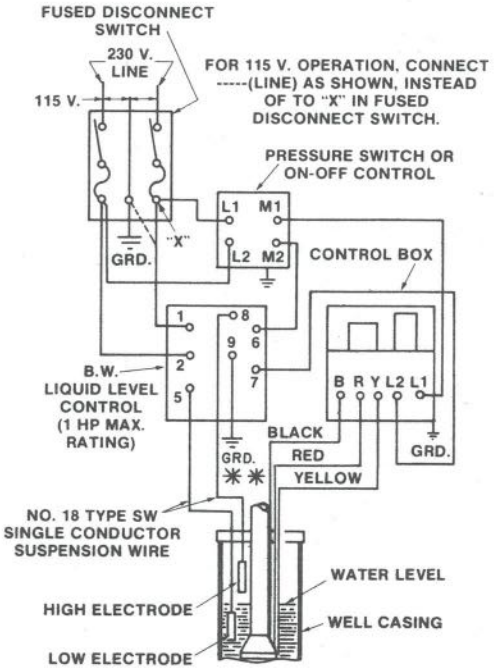
INSTALLATION WIRING DIAGRAM
Single phase, 3 Wire
1½ thru 15HP, w/Pressure Switch
w/Separate Contactor



INSTALLATION WIRING DIAGRAM
Three Phase, 3/4 HP and Larger w/Pressure Switch

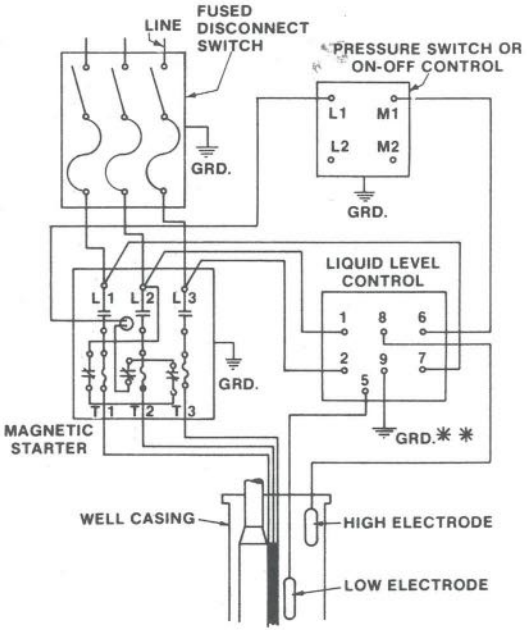


INSTALLATION WIRING DIAGRAM
Single Phase, 3-Wire 1/3 thru 1 HP, w/Pressure Switch w/Level Control



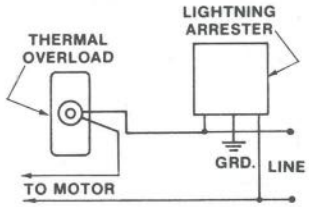
****Liquid level control ground connection should be made to metal drop pipe or metal well casing.**

INSTALLATION WIRING DIAGRAM
Three Phase, 3/4 HP and Larger w/Pressure Switch, w/Level Control

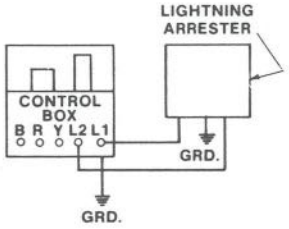


**Liquid level control ground connection should be made to metal drop pipe or metal well casing.

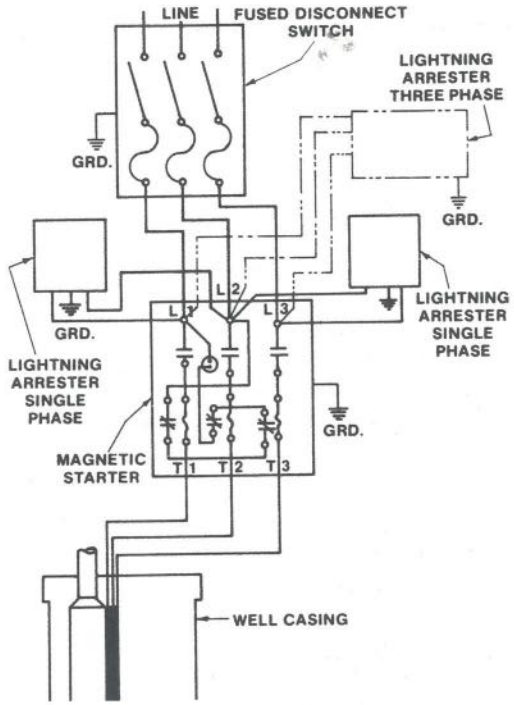
LIGHTNING ARRESTER INSTALLATION WIRING DIAGRAM
Single Phase, 2-Wire



LIGHTNING ARRESTER INSTALLATION WIRING DIAGRAM
Single Phase, 3-Wire



LIGHTNING ARRESTER INSTALLATION WIRING DIAGRAM
Three Phase



8. Cable Selection Charts

SUBMERSIBLE CABLE WIRE SIZE SELECTION CHART
TWO-WIRE PUMPS—115/230 VOLTS - 60 HERTZ - 1 PHASE

Horsepower		1/3		1/2		3/4	1
Voltage		115	230	115	230	230	230
Amp Rating	Max. Load Amps	8.2	3.5	9.6	4.3	6.4	7.8
Wire Size	14	100	415	90	310	220	160
	12	165	—	145	495	345	260
	10	260	—	230	780	550	410
	8	—	—	365	—	880	655

NOTE: Use max. load amps to determine required size wire.
NOTE: Chart values are maximum length of wire from power source to motor, in feet.

SUBMERSIBLE CABLE WIRE SIZE SELECTION CHART

THREE WIRE PUMPS — 115 VOLTS - 60 HERTZ - 1 PHASE

	AWG WIRE SIZE							
AMPS	**14**	**12**	**10**	**8**	**6**	**4**	**2**	**0**
2	595	945	1485	2320	3605	5540	8415	—
3	400	630	990	1545	2405	3695	5510	7550
4	300	475	740	1160	1805	2770	4210	5660
5	240	380	595	930	1445	2215	3365	4530
6	200	315	495	775	1200	1850	2805	3775
7	170	270	425	665	1030	1585	2405	3235
8	150	235	370	580	900	1385	2105	2830
9	135	210	330	515	800	1230	1870	2515
10	120	190	300	465	720	1110	1585	2265
12	100	160	250	385	600	925	1405	1890
14	—	135	215	330	515	790	1205	1620
16	—	120	185	290	450	695	1055	1415
18	—	—	165	260	400	615	935	1260
20	—	—	150	235	360	555	840	1135
22	—	—	135	210	330	505	765	1030
24	—	—	125	195	300	465	700	945
26	—	—	—	180	280	430	650	870
28	—	—	—	165	260	395	600	810
30	—	—	—	155	240	370	560	755

NOTE: Use maximum load amps to determine required size wire.
NOTE: Chart values are maximum length of wire from power source to motor, in feet.

SUBMERSIBLE CABLE WIRE SIZE SELECTION CHART

THREE-WIRE PUMPS — 200 VOLTS - 60 HERTZ - 1 PHASE

	AWG WIRE SIZE							
AMPS	**14**	**12**	**10**	**8**	**6**	**4**	**2**	**0**
2	1035	1645	2580	4030	6265	9635	—	—
3	690	1095	1720	2690	4180	6425	9755	—
4	520	820	1290	2015	3135	4820	7315	9845
5	415	660	1030	1515	2505	3855	5855	7875
6	345	550	860	1345	2090	3215	4880	6565
7	295	470	740	1150	1790	2755	4180	5625
8	260	410	645	1010	1565	2410	3660	4925
9	230	365	575	895	1395	2140	3255	4375
10	210	330	515	805	1255	1930	2925	3940
12	175	275	430	675	1045	1605	2440	3285
14	—	235	370	575	895	1380	2090	2815
16	—	205	325	505	785	1205	1830	2460
18	—	—	285	450	695	1070	1625	2190
20	—	—	260	405	630	965	1465	1970
22	—	—	235	370	570	875	1330	1790
24	—	—	215	335	525	805	1220	1640
26	—	—	—	310	485	740	1125	1515
28	—	—	—	290	450	690	1045	1405

NOTE: Use maximum load amps to determine required size wire.
NOTE: Chart values are maximum length of wire from power source to motor, in feet.

SUBMERSIBLE CABLE WIRE SIZE SELECTION CHART

THREE-WIRE PUMPS—200 VOLTS - 60 HERTZ - 1 PHASE

	AWG WIRE SIZE							
AMPS	**8**	**6**	**4**	**2**	**0**	**2/0**	**3/0**	**4/0**
30	270	420	645	975	1315	1570	1845	2155
35	230	360	550	835	1125	1345	1580	1850
40	200	315	485	730	985	1180	1385	1520
45	—	280	430	650	875	1050	1230	1440
50	—	250	385	585	790	945	1110	1295
55	—	—	350	535	715	855	1005	1175
60	—	—	320	490	655	735	925	1080
65	—	—	300	450	605	725	855	995
70	—	—	—	420	565	575	790	925
75	—	—	—	390	525	530	740	865
80	—	—	—	365	495	590	695	810
85	—	—	—	345	465	555	650	760
90	—	—	—	325	440	525	615	720
95	—	—	—	—	415	495	585	580
100	—	—	—	—	395	470	555	550

NOTE: Use maximum load amps to determine required size wire.
NOTE: Chart values are maximum length of wire from power source to motor, in feet.

SUBMERSIBLE CABLE WIRE SIZE SELECTION CHART

THREE-WIRE PUMPS—230 VOLTS - 60 HERTZ - 1 PHASE

	AWG WIRE SIZE							
AMPS	**14**	**12**	**10**	**8**	**6**	**4**	**2**	**0**
2	1195	1890	2965	4635	7205	—	—	—
3	795	1260	1975	3090	4805	7390	—	—
4	595	945	1485	2320	3605	5540	8415	—
5	480	755	1185	1855	2885	4435	6730	9060
6	400	630	990	1545	2405	3695	5510	7550
7	340	540	850	1325	2060	3165	4810	6470
8	300	475	740	1160	1805	2770	4210	5660
9	265	420	660	1030	1600	2465	3740	5035
10	240	380	595	930	1445	2215	3365	4530
12	200	315	495	775	1200	1850	2305	3775
14	—	270	425	665	1030	1585	2405	3235
16	—	235	370	580	900	1385	2105	2830
18	—	—	330	515	800	1230	1870	2515
20	—	—	300	465	720	1110	1685	2265
22	—	—	270	420	655	1010	1530	2060
24	—	—	250	385	600	925	1405	1890
26	—	—	—	355	555	855	1295	1745
28	—	—	—	330	515	790	1205	1620

NOTE: Use maximum load amps to determine required size wire.
NOTE: Chart values are maximum length of wire from power source to motor, in feet.

SUBMERSIBLE CABLE WIRE SIZE SELECTION CHART

THREE-WIRE PUMPS—230 VOLTS - 60 HERTZ - 1 PHASE

	AWG WIRE SIZE							
AMPS	**8**	**6**	**4**	**2**	**0**	**2/0**	**3/0**	**4/0**
30	310	480	740	1125	1510	1805	2120	2480
35	265	415	635	965	1295	1550	1820	2125
40	235	360	555	840	1135	1355	1590	1860
45	—	320	495	750	1010	1205	1415	1655
50	—	290	445	675	905	1085	1275	1490
55	—	—	405	615	825	985	1160	1355
60	—	—	370	560	755	905	1060	1240
65	—	—	340	520	700	835	980	1145
70	—	—	—	480	650	775	910	1065
75	—	—	—	450	605	725	850	995
80	—	—	—	420	565	680	795	930
85	—	—	—	395	535	640	750	875
90	—	—	—	375	505	605	710	830
95	—	—	—	—	480	570	670	785
100	—	—	—	—	455	545	635	745

NOTE: Use maximum load amps to determine required size wire.
NOTE: Chart values are maximum length of wire from power source to motor, in feet.

SUBMERSIBLE CABLE WIRE SIZE SELECTION CHART

THREE-WIRE PUMPS—200 VOLTS - 60 HERTZ - 3 PHASE

	AWG WIRE SIZE							
AMPS	**14**	**12**	**10**	**8**	**6**	**4**	**2**	**0**
2	1200	1895	2975	4655	7235	—	—	—
3	800	1265	1985	3105	4825	7420	—	—
4	600	950	1490	2330	3620	5565	8450	—
5	480	760	1190	1865	2895	4450	6750	9095
6	400	635	995	1555	2415	3710	5635	7580
7	345	545	850	1330	2070	3180	4330	6495
8	300	475	745	1165	1810	2785	4225	5685
9	265	425	665	1035	1610	2475	3755	5055
10	240	380	595	930	1450	2225	3380	4550
12	200	315	495	775	1205	1855	2815	3790
14	—	270	425	665	1035	1590	2415	3250
16	—	240	375	585	905	1390	2115	2845
18	—	—	330	520	805	1240	1880	2530
20	—	—	300	465	725	1115	1690	2275
22	—	—	270	425	660	1015	1535	2070
24	—	—	250	390	605	930	1410	1895
26	—	—	—	360	560	855	1300	1750
28	—	—	—	335	520	795	1210	1625

NOTE: Use maximum load amps to determine required size wire.
NOTE: Chart values are maximum length of wire from power source to motor, in feet.

SUBMERSIBLE CABLE WIRE SIZE SELECTION CHART

THREE-WIRE PUMPS—200 VOLTS - 60 HERTZ - 3 PHASE

	AWG WIRE SIZE							
AMPS	8	6	4	2	0	2/0	3/0	4/0
30	310	485	745	1130	1515	1815	2130	2490
35	265	415	635	965	1300	1555	1825	2135
40	235	365	560	845	1140	1360	1600	1870
45	—	325	495	750	1010	1210	1420	1660
50	—	290	445	675	910	1090	1280	1495
55	—	—	405	615	830	990	1165	1360
60	—	—	370	565	760	910	1065	1245
65	—	—	345	520	700	840	985	1150
70	—	—	—	485	650	780	915	1070
75	—	—	—	450	610	725	855	995
80	—	—	—	425	570	680	800	935
85	—	—	—	400	535	640	755	880
90	—	—	—	375	505	605	710	830
95	—	—	—	—	480	575	675	790
100	—	—	—	—	455	545	640	750

NOTE: Use maximum load amps to determine required size wire.
NOTE: Chart values are maximum length of wire from power source to motor, in feet.

SUBMERSIBLE CABLE WIRE SIZE SELECTION CHART

THREE-WIRE PUMPS—230 VOLTS - 60 HERTZ - 3 PHASE

	AWG WIRE SIZE							
AMPS	14	12	10	8	6	4	2	0
2	1380	2180	3425	5355	8320	—	—	—
3	920	1455	2285	3570	5550	8530	—	—
4	690	1090	1715	2675	4160	6400	9715	—
5	550	875	1370	2140	3330	5120	7775	—
6	460	730	1140	1785	2775	4265	6480	8715
7	395	625	980	1530	2380	3655	5555	7470
8	345	545	855	1340	2080	3200	4860	6540
9	305	485	760	1190	1850	2845	4320	5810
10	275	435	685	1070	1665	2560	3885	5230
12	230	365	570	895	1390	2135	3240	4360
14	—	315	490	765	1190	1830	2775	3735
16	—	275	430	670	1040	1600	2430	3270
18	—	—	380	595	925	1425	2160	2905
20	—	—	345	535	835	1280	1945	2615
22	—	—	315	490	760	1165	1770	2380
24	—	—	285	445	695	1070	1620	2180
26	—	—	—	415	640	985	1495	2015
28	—	—	—	385	595	915	1390	1870

NOTE: Use maximum load amps to determine required size wire.
NOTE: Chart values are maximum length of wire from power source to motor, in feet.

SUBMERSIBLE CABLE WIRE SIZE SELECTION CHART

THREE-WIRE PUMPS—230VOLTS - 60 HERTZ - 3 PHASE

	AWG WIRE SIZE							
AMPS	8	6	4	2	0	2/0	3/0	4/0
30	360	555	855	1295	1745	2085	2450	2865
35	305	475	735	1110	1495	1790	2100	2455
40	270	420	640	975	1310	1565	1840	2150
45	—	370	570	865	1165	1390	1635	1910
50	—	335	515	780	1045	1250	1470	1720
55	—	—	465	710	950	1140	1340	1565
60	—	—	430	650	875	1045	1225	1435
65	—	—	395	600	805	965	1130	1325
70	—	—	—	555	750	895	1050	1230
75	—	—	—	520	700	835	980	1145
80	—	—	—	485	655	785	920	1075
85	—	—	—	460	615	735	865	1010
90	—	—	—	435	585	695	820	955
95	—	—	—	—	550	660	775	905
100	—	—	—	—	525	625	735	860
120	—	—	—	—	—	525	615	715

NOTE: Use maximum load amps to determine required size wire.
NOTE: Chart values are maximum length of wire from power source to motor, in feet.

SUBMERSIBLE CABLE WIRE SIZE SELECTION CHART

THREE-WIRE PUMPS—460 VOLTS - 60 HERTZ - 3 PHASE

	AWG WIRE SIZE							
AMPS	14	12	10	8	6	4	2	0
2	2755	4360	6845	—	—	—	—	—
3	1835	2910	4565	7135	—	—	—	—
4	1380	2180	3425	5355	8320	—	—	—
5	1105	1745	2740	4285	6660	—	—	—
6	920	1455	2285	3570	5550	8530	—	—
7	790	1245	1955	3060	4755	7310	—	—
8	690	1090	1715	2675	4160	6400	9715	—
9	615	970	1525	2380	3700	5690	8635	—
10	550	875	1370	2140	3330	5120	7775	—
12	460	730	1140	1785	2775	4265	6480	8715
14	—	625	980	1530	2380	3655	5555	7470
16	—	545	855	1340	2080	3200	4860	6540
18	—	—	760	1190	1850	2845	4320	5810
20	—	—	685	1070	1665	2560	3885	5230
22	—	—	625	975	1515	2330	3535	4755
24	—	—	570	895	1390	2135	3240	4360
26	—	—	—	825	1280	1970	2990	4025
28	—	—	—	765	1190	1830	2775	3735

NOTE: Use maximum load amps to determine required size wire.
NOTE: Chart values are maximum length of wire from power source to motor, in feet.

SUBMERSIBLE CABLE WIRE SIZE SELECTION CHART
THREE-WIRE PUMPS—460 VOLTS - 60 HERTZ - 3 PHASE

	AWG WIRE SIZE							
AMPS	**8**	**6**	**4**	**2**	**0**	**2/0**	**3/0**	**4/0**
30	715	1110	1705	2590	3490	4170	4900	5730
35	615	950	1465	2220	2990	3575	4200	4910
40	535	835	1280	1945	2615	3130	3675	4295
45	—	740	1140	1730	2325	2780	3270	3820
50	—	665	1025	1555	2095	2505	2940	3435
55	—	—	930	1415	1905	2275	2675	3125
60	—	—	855	1295	1745	2085	2450	2865
65	—	—	790	1195	1610	1925	2265	2645
70	—	—	—	1110	1495	1790	2100	2455
75	—	—	—	1040	1395	1670	1960	2290
80	—	—	—	975	1310	1565	1840	2150
85	—	—	—	915	1230	1475	1730	2025
90	—	—	—	865	1165	1390	1635	1910
95	—	—	—	—	1100	1320	1550	1810
100	—	—	—	—	1045	1250	1470	1720

NOTE: Use maximum load amps to determine required size wire.
NOTE: Chart values are maximum length of wire from power source to motor, in feet.

SUBMERSIBLE CABLE WIRE SELECTION CHART
THREE-WIRE PUMPS—460 VOLTS—60 HERTZ—3 PHASE

	AWG WIRE SIZE											
AMPS	**2/0**	**3/0**	**4/0**	**250**	**300**	**350**	**400**	**500**	**600**	**700**	**750**	**1000**
120	1045	1225	1435	1535	1710	1870	1985	2210	2345	2490	2550	2695
140	895	1050	1230	1315	1470	1605	1700	1895	2010	2135	2185	2310
160	—	920	1075	1150	1285	1405	1490	1655	1755	1865	1910	2020
180	—	—	955	1020	1140	1245	1325	1475	1560	1660	1700	1800
200	—	—	—	920	1030	1125	1190	1325	1405	1495	1530	1620
225	—	—	—	—	915	1000	1060	1180	1250	1330	1360	1440
250	—	—	—	—	—	—	955	1060	1125	1195	1225	1295
275	—	—	—	—	—	—	—	965	1025	1085	1115	1175
300	—	—	—	—	—	—	—	885	940	995	1020	1080
325	—	—	—	—	—	—	—	—	865	920	940	995
350	—	—	—	—	—	—	—	—	—	855	875	925
375	—	—	—	—	—	—	—	—	—	—	815	865
400	—	—	—	—	—	—	—	—	—	—	—	810
425	—	—	—	—	—	—	—	—	—	—	—	760

NOTE: Use maximum load amps to determine required size wire.
NOTE: Chart values are maximum length of wire from power source to motor, in feet.

SUBMERSIBLE CABLE WIRE SIZE SELECTION CHART

THREE-WIRE PUMPS—575 VOLTS - 60 HERTZ - 3 PHASE

	AWG WIRE SIZE							
AMPS	14	12	10	8	6	4	2	0
2	3445	5450	8555	—	—	—	—	—
3	2295	3635	5705	8920	—	—	—	—
4	1720	2725	4280	6690	—	—	—	—
5	1380	2180	3425	5355	8320	—	—	—
6	1150	1820	2855	4460	6935	—	—	—
7	985	1560	2445	3825	5945	9140	—	—
8	860	1365	2140	3345	5200	8000	—	—
9	765	1215	1905	2975	4625	7110	—	—
10	690	1090	1715	2675	4160	6400	9715	—
12	575	910	1425	2230	3470	5330	8095	—
14	—	780	1225	1915	2975	4570	6940	9340
16	—	685	1070	1675	2600	4000	6075	8170
18	—	—	950	1490	2315	3555	5400	7265
20	—	—	855	1340	2080	3200	4860	6540
22	—	—	780	1220	1890	2910	4415	5945
24	—	—	715	1115	1735	2665	4050	5450
26	—	—	—	1030	1600	2460	3740	5030
28	—	—	—	955	1485	2285	3470	4670

NOTE: Use maximum load amps to determine required size wire.
NOTE: Chart values are maximum length of wire from power source to motor, in feet.

SUBMERSIBLE CABLE WIRE SIZE SELECTION CHART

THREE-WIRE PUMPS—575 VOLTS - 60 HERTZ - 3 PHASE

	AWG WIRE SIZE							
AMPS	8	6	4	2	0	2/0	3/0	4/0
30	895	1390	2135	3240	4360	5215	6125	7160
35	765	1190	1830	2775	3735	4470	5250	6135
40	670	1040	1600	2430	3270	3910	4595	5370
45	—	925	1425	2160	2905	3475	4085	4775
50	—	835	1280	1945	2615	3130	3675	4295
55	—	—	1165	1770	2380	2845	3340	3905
60	—	—	1070	1620	2180	2605	3065	3580
65	—	—	985	1495	2015	2405	2830	3305
70	—	—	—	1390	1870	2235	2625	3070
75	—	—	—	1295	1745	2085	2450	2865
80	—	—	—	1215	1635	1955	2300	2685
85	—	—	—	1145	1540	1840	2165	2530
90	—	—	—	1080	1455	1740	2045	2385
95	—	—	—	—	1380	1645	1935	2260
100	—	—	—	—	1310	1565	1840	2150

NOTE: Use maximum load amps to determine required size wire.
NOTE: Chart values are maximum length of wire from power source to motor, in feet.

SUBMERSIBLE CABLE WIRE SELECTION CHART
THREE-WIRE PUMPS—575 VOLTS—60 HERTZ—3 PHASE

	AWG WIRE SIZE											
AMPS	2/0	3/0	4/0	250	300	350	400	500	600	700	750	1000
120	1305	1535	1790	1915	2140	2335	2480	2750	2930	3110	3185	3870
140	1120	1315	1535	1640	1835	2005	2125	2365	2510	2665	2730	2890
160	—	1150	1345	1435	1605	1755	1860	2070	2195	2335	2390	2530
180	—	—	1195	1275	1425	1560	1655	1840	1950	2075	2125	2245
200	—	—	—	1150	1285	1405	1490	1655	1755	1865	1910	2020
225	—	—	—	—	1140	1245	1325	1475	1560	1660	1700	1800
250	—	—	—	—	—	—	1190	1325	1405	1495	1530	1620
275	—	—	—	—	—	—	—	1205	1280	1360	1390	1470
300	—	—	—	—	—	—	—	1105	1170	1245	1275	1350
325	—	—	—	—	—	—	—	—	1080	1150	1175	1245
350	—	—	—	—	—	—	—	—	—	1065	1095	1155
375	—	—	—	—	—	—	—	—	—	—	1020	1080
400	—	—	—	—	—	—	—	—	—	—	—	1010
425	—	—	—	—	—	—	—	—	—	—	—	950

NOTE: Use maximum load amps to determine required size wire.
NOTE: Chart values are maximum length of wire from power source to motor, in feet.

SUBMERSIBLE CABLE WIRE SIZE SELECTION CHART
THREE-WIRE PUMPS—CABLE LENGTH IN METERS - 220 VOLTS - 50 HERTZ - 1 PHASE

	SQ MM WIRE SIZE							
AMPS	2.5	4	6	10	15	25	35	50
2	390	695	—	—	—	—	—	—
3	260	465	705	—	—	—	—	—
4	195	350	530	835	—	—	—	—
5	155	275	425	665	—	—	—	—
6	130	230	350	555	850	—	—	—
7	110	200	300	475	730	—	—	—
8	95	175	265	415	640	980	—	—
9	85	155	235	370	565	870	—	—
10	75	140	210	335	510	785	980	—
12	65	115	175	275	425	650	815	—
14	55	100	150	240	365	560	700	895
16	50	85	130	205	320	490	610	785
18	45	75	115	185	285	435	545	695
20	40	70	105	165	255	390	490	625
22	35	65	95	150	230	355	445	570
24	—	60	85	140	210	325	405	525
26	—	50	80	130	195	300	375	480
28	—	50	75	120	180	280	350	445
30	—	45	70	110	170	260	325	420
35	—	—	60	95	145	225	280	360

NOTE: Use maximum load amps to determine required size wire.
NOTE: Chart values are maximum length of wire from power source to motor, in feet.

SUBMERSIBLE CABLE WIRE SIZE SELECTION CHART

THREE-WIRE PUMPS—CABLE LENGTH IN METERS - 220 VOLTS - 50 HERTZ - 1 PHASE

	SQ MM WIRE SIZE							
AMPS	**6**	**10**	**16**	**25**	**35**	**50**	**70**	**95**
40	50	85	125	195	245	315	400	485
45	—	75	115	175	215	280	355	430
50	—	65	100	155	195	250	320	390
55	—	—	90	140	175	225	290	355
60	—	—	85	130	160	210	265	325
65	—	—	75	120	150	195	245	300
70	—	—	—	110	140	180	225	275
75	—	—	—	105	130	165	210	260
80	—	—	—	95	120	155	200	240
85	—	—	—	90	115	145	185	230
90	—	—	—	85	110	140	175	215
95	—	—	—	—	105	130	170	205
100	—	—	—	—	95	125	160	195

NOTE: Use maximum load amps to determine required size wire.
NOTE: Chart values are maximum length of wire from power source to motor, in feet.

SUBMERSIBLE CABLE WIRE SIZE SELECTION CHART

THREE-WIRE PUMPS—CALBE LENGTH IN METERS - 220 VOLTS - 50 HERTZ - 3 PHASE

	SQ MM WIRE SIZE							
AMPS	**2.5**	**4**	**6**	**10**	**15**	**25**	**35**	**50**
2	450	805	—	—	—	—	—	—
3	300	535	815	—	—	—	—	—
4	225	400	610	965	—	—	—	—
5	180	320	490	770	—	—	—	—
6	150	270	405	640	985	—	—	—
7	130	230	350	550	840	—	—	—
8	115	200	305	480	735	—	—	—
9	100	180	270	430	655	—	—	—
10	90	160	245	385	590	905	—	—
12	75	135	205	320	490	755	945	—
14	65	115	175	275	420	645	810	—
16	55	100	150	240	370	565	705	905
18	50	90	135	215	325	500	630	805
20	45	80	120	190	295	450	565	725
22	40	75	110	175	270	410	515	660
24	—	65	100	160	245	375	470	605
26	—	60	95	150	225	350	435	555
28	—	55	85	135	210	325	405	515
30	—	55	80	130	195	300	375	485
35	—	—	70	110	170	260	325	415

NOTE: Use maximum load amps to determine required size wire.
NOTE: Chart values are maximum length of wire from power source to motor, in feet.

SUBMERSIBLE CABLE WIRE SIZE SELECTION CHART

THREE-WIRE PUMPS—CABLE LENGTH IN METERS - 220 VOLTS - 50 HERTZ - 3 PHASE

	SQ MM WIRE SIZE							
AMPS	6	10	16	25	35	50	70	95
40	60	95	145	225	280	360	460	560
45	—	85	130	200	250	320	410	500
50	—	75	120	180	225	290	370	450
55	—	—	105	165	205	265	335	410
60	—	—	100	150	190	240	305	375
65	—	—	90	140	175	225	285	345
70	—	—	—	130	160	205	265	320
75	—	—	—	120	150	195	245	300
80	—	—	—	115	140	180	230	280
85	—	—	—	105	135	170	215	265
90	—	—	—	100	125	160	205	250
95	—	—	—	—	120	150	195	235
100	—	—	—	—	115	145	185	225

NOTE: Use maximum load amps to determine required size wire.
NOTE: Chart values are maximum length of wire from power source to motor, in feet.

SUBMERSIBLE CABLE WIRE SIZE SELECTION CHART

THREE-WIRE PUMPS—CABLE LENGTH IN METERS - 415 VOLTS - 50 HERTZ - 3 PHASE

	SQ MM WIRE SIZE							
AMPS	2.5	4	6	10	16	25	35	50
2	855	—	—	—	—	—	—	—
3	570	—	—	—	—	—	—	—
4	425	760	—	—	—	—	—	—
5	340	605	925	—	—	—	—	—
6	285	505	770	—	—	—	—	—
7	245	435	660	—	—	—	—	—
8	215	380	575	910	—	—	—	—
9	190	335	510	810	—	—	—	—
10	170	305	460	725	—	—	—	—
12	140	250	385	605	925	—	—	—
14	120	215	330	520	795	—	—	—
16	105	190	290	455	695	—	—	—
18	95	170	255	405	620	950	—	—
20	85	150	230	365	555	855	—	—
22	75	135	210	330	505	775	970	—
24	—	125	190	305	465	710	890	—
26	—	115	175	280	430	655	820	—
28	—	110	165	260	395	610	760	975
30	—	100	155	240	370	570	710	910
35	—	—	130	205	320	485	610	780

NOTE: Use maximum load amps to determine required size wire.
NOTE: Chart values are maximum length of wire from power source to motor, in feet.

SUBMERSIBLE CABLE WIRE SIZE SELECTION CHART

THREE-WIRE PUMPS—CABLE LENGTH IN METERS - 415 VOLTS - 50 HERTZ - 3 PHASE

	SQ MM WIRE SIZE							
AMPS	**6**	**10**	**16**	**25**	**35**	**50**	**70**	**95**
40	115	180	280	425	535	685	870	—
45	—	160	245	380	475	605	770	940
50	—	145	220	340	425	545	695	845
55	—	—	200	310	390	495	630	770
60	—	—	185	285	355	455	580	705
65	—	—	170	260	330	420	535	650
70	—	—	—	245	305	390	495	605
75	—	—	—	225	285	365	465	565
80	—	—	—	215	265	340	435	530
85	—	—	—	200	250	320	410	500
90	—	—	—	190	235	305	385	470
95	—	—	—	—	225	285	365	445
100	—	—	—	—	215	275	345	425

NOTE: Use max. load amps to determine required size wire.
NOTE: Chart values are maximum length of wire from power source to motor, in feet.

SUBMERSIBLE CABLE WIRE SIZE SELECTION CHART

THREE-WIRE PUMPS—CABLE LENGTH IN METERS - 380 VOLTS - 50 HERTZ - 3 PHASE

	SQ MM WIRE SIZE							
AMPS	**2.5**	**4**	**6**	**10**	**16**	**25**	**35**	**50**
2	780	—	—	—	—	—	—	—
3	520	925	—	—	—	—	—	—
4	390	695	—	—	—	—	—	—
5	310	555	845	—	—	—	—	—
6	260	465	705	—	—	—	—	—
7	225	395	605	950	—	—	—	—
8	195	345	530	830	—	—	—	—
9	175	310	470	740	—	—	—	—
10	155	275	420	665	—	—	—	—
12	130	230	350	555	850	—	—	—
14	110	200	300	475	725	—	—	—
16	95	175	265	415	635	975	—	—
18	85	155	235	370	565	870	—	—
20	80	140	210	330	510	780	975	—
22	70	125	190	300	465	710	890	—
24	—	115	175	275	425	650	815	—
26	—	105	160	255	390	600	750	965
28	—	100	150	235	365	560	700	895
30	—	90	140	220	340	520	650	835
35	—	—	120	190	290	445	560	715

NOTE: Use max. load amps to determine required size wire.
NOTE: Chart values are maximum length of wire from power source to motor, in feet.

SUBMERSIBLE CABLE WIRE SELECTION CHART

THREE-WIRE PUMPS—CABLE LENGTH IN METERS - 380 VOLTS - 50 HERTZ - 3 PHASE

	SQ MM WIRE SIZE							
AMPS	**6**	**10**	**16**	**25**	**35**	**50**	**70**	**95**
40	105	165	255	390	490	625	795	970
45	—	145	225	345	435	555	705	860
50	—	135	205	310	390	500	635	775
55	—	—	185	285	355	455	580	705
60	—	—	170	260	325	415	530	645
65	—	—	155	240	300	385	490	595
70	—	—	—	225	280	355	455	555
75	—	—	—	210	260	335	425	515
80	—	—	—	195	245	315	400	485
85	—	—	—	185	230	295	375	455
90	—	—	—	175	215	280	355	430
95	—	—	—	—	205	265	335	410
100	—	—	—	—	195	250	320	385

NOTE: Use max. load amps to determine required size wire.
NOTE: Chart values are maximum length of wire from power source to motor, in feet.

NOTES