Aqua Control, Inc.

60Hz. BOTTOM CIRCULATOR INSTRUCTION MANUAL

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SAFETY INFORMATION

WARNING

This product is not intended for use by young children or infirm persons unless they have been adequately supervised by a responsible person to ensure that they can operate the product safely.

Young children should be supervised to ensure that they do not play with the product.

Your Aqua Control, Inc. products are made entirely of corrosion resistant materials including stainless steel, aluminum alloy, bronze and engineered plastics. They will provide safe, long and satisfactory service if properly installed, operated and maintained.

1. Follow all applicable local and state electrical codes.
2. Protect exposed or vulnerable wiring with tubing or conduit.
3. Do not operate the unit when it is obvious the flow rate is reduced.
4. Do not work on the unit when it is turned on or operating.
5. Follow all normal safety precautions when working in and around the water.
6. Prevent tension on the electrical wires.
7. Do not carry or pull the unit by the lights or by the cable. Use the finger pockets on the float.
8. Never try to dislodge debris from the impeller or propeller while the motor is connected to the power supply.
9. Always verify the control panel and all electrical equipment are grounded properly.
10. Any time high voltage electricity is used under water, a potential safety hazard exists. Aqua Control, Inc. builds and provides UL listed control panels that are standard equipped with a Class A Ground fault Circuit Interrupter (GFCI) for the motors. Class A GFCI's are designed to provide protection against electrocution for people. They have a nominal trip level of 5 ma and are designed to shut the circuit off in 25 milli seconds. Such a system will shut off a current resulting from shorts or dangerous leakage, whether from the motor, electrical cables or controls, befor a hazardous current can develop.

PRE-ASSEMBLY

Prior to installing, verify the correct product has been ordered and received. Aqua Control, Inc. **will not** accept any returns for refund or exchange of product or components that have been installed in the water or modified in any way. Keep original packaging for returns to the factory or contact the factory for instructions as to how to obtain packaging for safe return of product.

1. **Check the packing list** that came with the shipment. Make certain all the boxes have been received. Each label will have a box number and total for the shipment (1 of 5, 2 of 5). The packing list has the total number of boxes noted at the bottom.
2. **Check the pond depth.** Is the pond deep enough for the unit being installed?
3. **Verify the incoming voltage** where it will be connected to the control panel. Does the measured voltage match the rated motor voltage requirements? Note the HP, voltage and phase on the packing list.
4. **Is there a VFD operating** from the same power supply or in the vicinity that might interfere with the GFCI?

Bottom Circulator Installation and Operating Instructions

These instructions are for the design based on the floating sled concept, which is designed to initially float on the surface of the water and then sink to the bottom gently by adding removable weights. The weights can be temporarily removed and allow the unit to float to the surface for maintenance and cleaning. This is a high volume, medium pressure pump that is designed to pump large volumes of water from the bottom of the pond and circulate it to the surface.

INSTALLATION

1. Before installation of the Bottom Circulator, ensure that all ropes and cables are not tangled or twisted under the unit. The unit should be placed as close as possible to the water's edger with the front (output) end facing the shoreline.

2. Attach the mooring or anchoring rope to the front rope loops connected to the front tow eyebolts on the sled assembly. This rope must be capable of resisting the very considerable pump thrust and the tendency of that thrust from moving the pump assembly. The factory installed finder float attached to a bar weight is connected to the rope connected to the rear eyebolts.

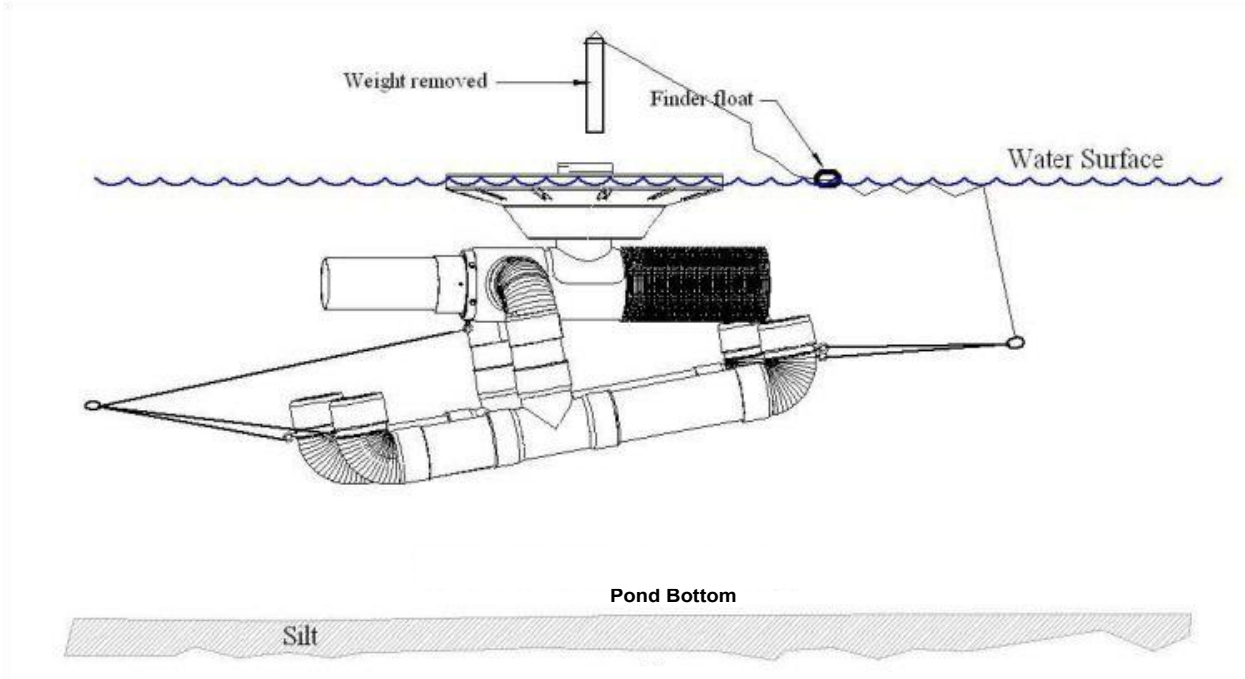
3. The unit is designed to float (when the large bar weight has been removed) and can then be towed to the install location. There is a second set of ropes tied to the rear of the sled that has a long rope tied to its loop and attached to the larger bar wieght. (Note that there is a small finder float on this rope which is used to locate the unit.) After adding the small bar weight to the center tube, the large bar weight is added. When the larger weight is added to the float tube, the unit will gently sink to the bottom. The finder float will float, showing the location of the rope that is attached to both the unit and the weight. When the unit needs to be floated or moved, the bar weight can be removed from the unit and it should float to the surface. At this time the pump assembly can be towed back to shore or inspected at the location. Should the unit not surface for any reason, the same rope may be used to help pull the unit up to the surface for further inspection or towed using the anchoring rope.

4. Select an area of the pond or lake for the installation where the bottom is relatively flat. This area must have less than one foot of silt on the bottom.

5. Float and move the Bottom Circulator out into the pond to the disired location.

(Installtion instructions continued on next page.)

Bottom Circulator shown floating



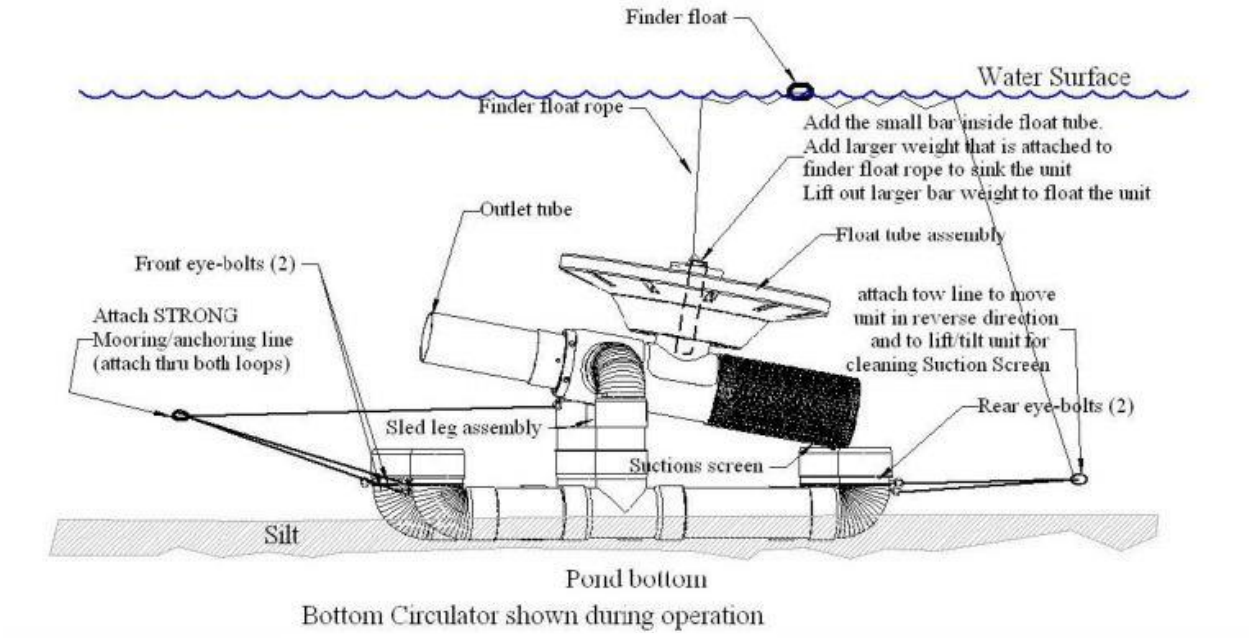
Bottom Circulator Installation and Operating Instructions

INSTALLATION (con't)

6. When the unit has been brought to the desired location, it may be lowered down into the water. See step #3 for the sinking instructions.

7. The entire Bottom Circulator must be submerged for proper operation. If it is submerged below the ice depth it iwll not be necessary to remove the unit during winter

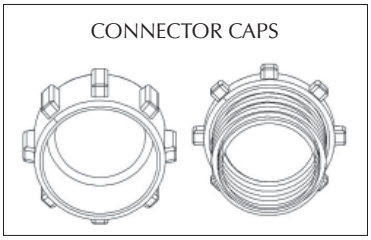
Bottom Circulator shown during Operation



Bottom Circulator shown during operation

CONNECTORS

CONNECTOR CAPS

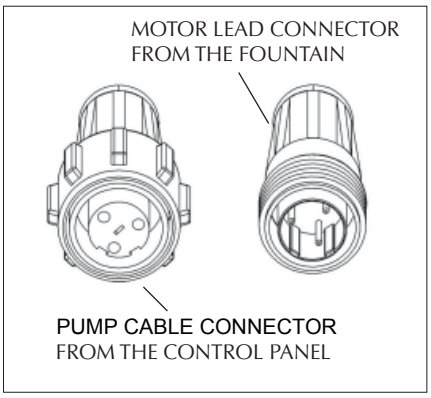


Blue quick disconnect caps are used to protect the quick disconnects during handling and to keep them dry if submerged while unconnected to mating quick disconnects.

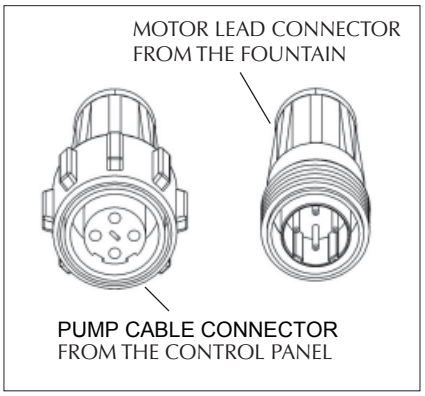
CONNECTOR IDENTIFICATION

WARNING: Do not use grease on connectors. No tools are required for tightening.

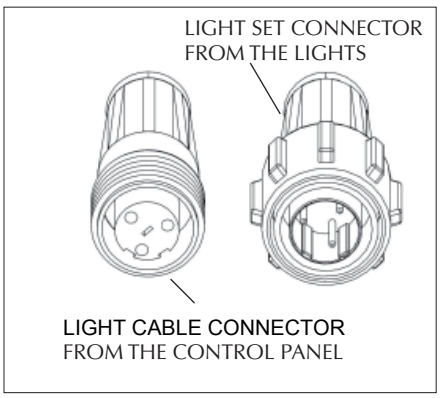
3-WIRE PUMP CABLE



4-WIRE PUMP CABLE

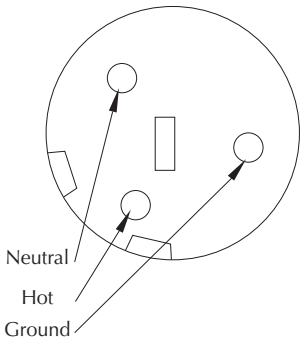


LIGHT CABLE

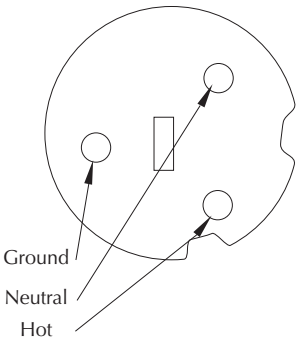


WIRE IDENTIFICATION

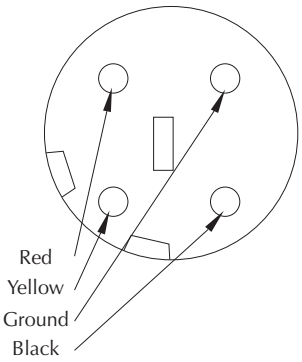
2 Wire with Ground
Motor Lead Connector
& Light Set Connector



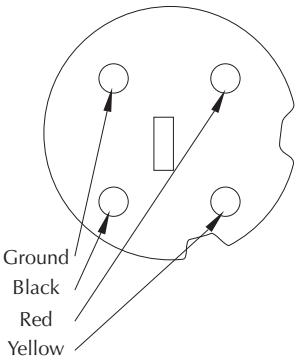
2 Wire with Ground
Pump Cable Connector
& Light Cable Connector



3 Wire with Ground
Motor Lead connector



3 Wire with Ground
Pump Cable Connector



CONTROL PANELS

INSTALLATION

Aqua Control Inc. (ACI) is certified to manufacture UL Listed Industrial Control Panels (UL 508A), and all control panels are UL listed except 460V panels or panels built with prior agreement for certain special configurations. Certain special configurations, the 1hp-115V, all 460V and all 575V control panels cannot be UL Listed because of the National Electric Code and UL requirements.
(If an ACI control panel was ordered with your unit, the control panel instruction manual may be found inside the control panel enclosure.)

LOCATION OF CONTROL PANELS

Control panels should always be installed in a manner that minimizes heat inside the panel since the panels generate some heat and they contain heat sensitive components (motor overloads). Sunlight is the most significant source of heat, so the control panels should be installed out of direct sun as much as possible. The door of the control panel, particularly, should not face south or west unless it is protected from sunlight.

ELECTRICAL CONNECTION

The motor lead is shipped wrapped inside plastic corrugated tubing on the outside of the pump unit. It is terminated with a blue plug. This must be connected to the matching plug at the pump power supply cable. The connection should be made before launching the pump assembly.

PRE-START UP

Verify voltage at the rotary disconnect prior to start up. Each outer leg should be 120 volts to Neutral unless you have 460/480 volt 3-phase power. If you have power with a hot leg e.g., 230 volt 3-phase power, that wire should be connected to the center lug of the rotary disconnect.

It is good practice to provide power to the motor for a few seconds prior to installing the unit. This provides an opportunity to verify that a 3-phase motor will spin in the correct, counter-clockwise direction. This also, ensures that all wiring is correct.

START UP

At installation and initial start up, it is recommended to record the actual voltage under load (while the unit is running) and the running amperage of the unit. This can be kept inside the control panel for future reference. This allows for easy determination if something at site or with the installation has changed. The correct voltage and amperage ratings are on the schematic and on the door label of the control panel.

Any Aqua Control, Inc. aerator can be operated continuously or intermittently as desired except during freezing weather. If a less than normal flow is observed, it is imperative that the cause be promptly investigated and corrected. Failure to do so can cause cavitation resulting in pump and motor damage and will void the warranty. Reduced flow will usually be due to a blockage that must be removed.

Anchoring

Extreme care must be taken to anchor the unit securely and in line with the thrust. A good quality marine anchor with flukes must be **very securely "set"** so it does not move from the thrust force of the Bottom Circulator and loosen.
CAUTION:
It is critically important to anchor securely since the pump creates a continuous 25 to 100 pounds of tension on the anchor rope. (Depending on the horsepower of the unit)

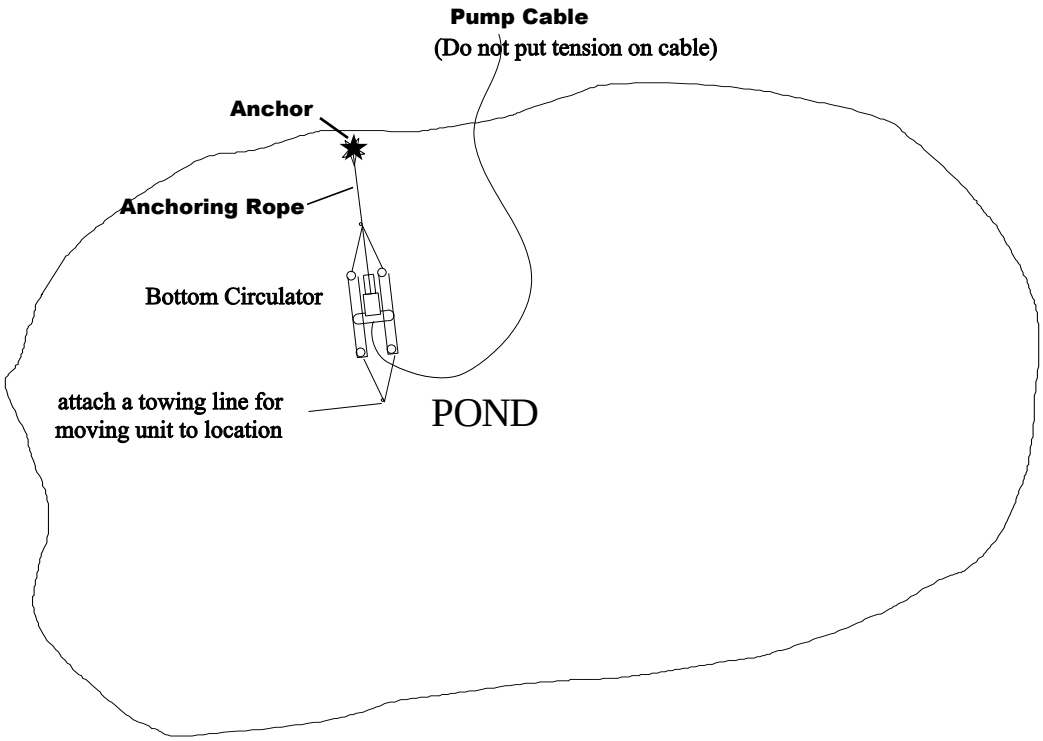
Anchoring Instructions

1. The anchoring line must be attached to the front rope loop and must be connected in the same line as the pump. This line must be **tight.**

2. Refer to step #3 in the Installation instructions. Use the anchor rope to guide the pointing direction while the unit is under the surface of the water.

3. The motor cable must be lead back to shore in a manner that does not put a tension on the cable.

Select Series Bottom Circulator Anchoring Diagram



TROUBLESHOOTING

GENERAL TROUBLESHOOTING

1. Set Up the Multimeter
    a. Ohms
        i. Know the range of Ohms available for your multimeter and whether your meter is auto-ranging.
        ii. Set the multimeter to the lowest Ohm (resistance) setting. Resistance is designated by Ohms.
        iii. Determine how your multimeter designates open line. Observe the reading when both probes are held in the air, not touching.
        iv. Determine how your multimeter designates continuity. This is done by touching the two probes. This should be either zero or very close to zero. If not zero, this may be resistance internal to the meter and should be subtracted from all subsequent readings. If your meter has an "auto-zero" feature, use it to zero the meter.
    b. Volts
        i. Set the multimeter to the highest setting
        ii. Select AC volts. This is usually designated by VAC.
    c. Amps - Use only a clamp ammeter e.g. Amprobe.

2. Check Neutral to Ground Voltage
    a. Set multimeter to AC voltage, highest rating.
    b. Check the voltage between Neutral and Ground.
    c. The voltage should be zero.
    d. If the voltage is other than zero, the neutral line may be bad.
    e. A bad neutral may lead to faulty GFCI tripping.

3. Check Input Voltages - readings should be within 10% of nominal voltage.
    a. Single Phase
        i. Each line to Neutral should be approximately ½ of the input voltage.
        ii. Each line to one another should be the source voltage.
    b. Three Phase
        i. 208 volt, Y
            1. Each line to Neutral should be 120 volts.
            2. Each line to one another should be source voltage.
        ii. volt, Delta
            1. L1 and L3 to Neutral should be half source voltage.
            2. L2 to Neutral should be substantially higher. This must be the wild leg connection.
        iii. volt / 480 volt grounded.
            1. Each line to Neutral should be approximately 277 volts.
            2. Each line to one another should be source voltage.
        iv. 480 volt Delta
            1. Each line to one another should be source voltage.
    c. Analysis
        i. If lines read good to Neutral but zero to one another, the same leg is used for both lines. Correct this at the source.
        ii. If the lines read bad to one another or bad to Neutral, the power source or power cable must be corrected
        iii. A three-phase 240 volt delta power source must have the wild leg connected to L2, the center input of the disconnect switch.

4. Check Output Voltages
    a. 2-Wire: T1 - T2
    b. 1-Phase: Black - Yellow
    c. 3-Phase: T1 – T2, T1 – T3, T2 – T3
    d. Analysis
        i. Each reading should give source voltage.
        ii. If good, problem is not in control panel although overloads or GFCIs may be too sensitive and cause premature tripping.
        iii. If zero voltage: backtrack through components, checking input vs. output voltages, to determine which one is tripped or faulty.
        iv. If low voltage: very unlikely, control panel wired incorrectly.

5. Check Amps – readings should be within 10% of nominal voltage.
    a. Single phase – check yellow wire.
    b. Three phase – check each hot wire; readings should be within 5% of one another.

6. If GFCI tripped, perform "GFCI Troubleshooting Procedures"

7. If overload tripped, perform "Overload Troubleshooting Procedures"

TROUBLESHOOTING

CABLE TROUBLESHOOTING

Two problems affect cable integrity, shorted lines and broken or open lines. the following porcedures will determine cable integrity, The cable should be disconnected from both the motor and the control panel. Verify the power is off before removing the cable.

1. Set up the multimeter

    a. Set the multimeter to the lowest Ohm (resistance) setting. Resistance is designated by Ohms.
    b. Determine how your multimeter designates open line. This is done by observing the reading when both probes are held in the air, not touching.
    c. Determine how your multimeter designates continuity. This is done by touching the two probes. This should be either zero or very close to zero. If not zero, this may be resistance internal to the meter and should be subtracted from all subsequent readings.

2. Disconnect the cable from the control panel and the load (pump or lights). Both ends must be dry. Verify the power is off before removing the cable.

3. Check for shorted lines. A short is an unintentional electrical path and can be caused by faulty insulation.

    a. Set the multimeter to the highest Ohm (resistance) setting.
    b. Take readings by touching the probes to each pair of wires; e.g. red-black, red-yellow, black-yellow, etc.
    c. Analyze the readings.
        i. The readings should be the same as the open line readings you observed in step 1b.
        ii. If the readings designate continuity by giving a zero reading or any reading less than open line, a short exists.
        iii. If any of the readings with green (ground) indicate continuity, a leak to ground exists.
    d. Determine the action to take
        i. Visually inspect the cable.
        ii. Any manual connection sites are candidates for inspection, e.g. junction boxes, splices.
        iii. It may be impossible to determine the location of the short and a new cable may be the best solution.

4. Check for open lines. An open line is a break in a wire.
    a. Set the multimeter to the lowest Ohm (resistance) setting.
    b. At the control panel, with the cable disconnected from the control panel, join two wires, e.g. red and yellow, by wrapping the ends together. If you have four wires, you may wish to connect the other two together. Note which wires are connected.
    c. From the other end of the cable select one of the pairs of joined wires and take reading by touching the probes to each wire or socket of the connector.
    d. Analyze the readings.
        i. The readings should indicate continuity, (either zero or close to zero). The readings should not exceed a few Ohms.
        ii. If the readings indicate either open line or a very high number, a break or partial break exists.
        iii. If a break exists, one or both of the wires tested may be involved.
        iv. Determine the action to take.
            1. Visually inspect teh cable.
            2. Any manual connection sites are candidates for inspection, e.g. junction boxes, splices.
            3. It may be impossible to determine the location of the open line and a new cable may be the best solution.
    e. Perform these steps for each combination of wire pairs.

TROUBLESHOOTING

MOTOR CONTROL BOX (MCB)

1. Test Overloads – perform test for each overload. Verify the power is off before testing.

    a. Overload identification
        i. Left overload is “Run” or “Main.”
        ii. Right overload is “Start.”
    b. Push red reset button to verify closure. It may be necessary to press these buttons very hard to reset.
    c. Set ohmmeter to lowest range.
    d. Test resistance between the two soldered connections on the top of the overload.
    e. If the resistance is less than 0.5 ohms, the overload is good.
    f. If the resistance is greater than 0.5 ohms, replace both overloads.

2. Check the amps on the red wire from MCB.

    a. This test requires careful attention. The amp readings may change within seconds.
    b. Power off the control panel.
    c. Attach the ammeter to the wire connected to the “RED” terminal of the MCB.
    d. Power on the control panel.
    e. If amps do not jump, go to “Test Capacitor” and check “Start” capacitors.
    f. If amps jump and stay high, go to “Test Relay.”
    g. If amps jump and return to zero, go to “Test Capacitor” and check “Run” capacitors.
    h. If amps jump and return to normal “Red” amps (see table below) the MCB is functioning correctly.
    i. Normal Amp Readings

HP	YELLOW AMPS	BLACK AMPS	RED AMPS
1	10	10	0
2	13	12	3
3	17	13	6
5	28	19	11

3. Test Capacitor. Verify the power is off before testing.

    a. Capacitor Identification – usually “Start” capacitors are large and black and “Run” capacitors are small and silver.
    b. Set ohmmeter to 20,000 ohms.
    c. Remove all wires from one terminal of the capacitor.
    d. Test resistance between the two terminals.
        i. Resistance should climb towards infinity (open line). If testing the 5HP Start Capacitor, the resistance should climb to 15,000 ohms.
        ii. If resistance does not climb, switch meter leads.
        iii. If the resistance still does not climb, replace capacitor.
    e. If the meter has capacitance checking capability, check the capacitance. See table below.
    f. Reconnect the leads to the capacitor.

HP	# RUN CAPS	RUN µF	# START CAPS	START µF
2	1	20	1	105-126
3	1	45	1	208-250
5	2	20/40	1	270-324

TROUBLESHOOTING

MOTOR CONTROL BOX (MCB) continued

4. Test Relay. Verify the power is off before testing.

    a. Test Coil
        i. Disconnect all wires from terminal 5 (upper right terminal); yellow wire and possibly red if panel has light circuit(s).
        ii. Set ohmmeter to 10,000 ohms.
        iii. Check resistance between terminals 2 (center terminal, red) and 5 (where the yellow wire was connected).
        iv. Readings between 4,500 ohms and 7,000 ohms are good.
        v. If resistances are out of that range, replace relay.
        vi. Reconnect the all wires removed from terminal 5 in step i.
    b. Test Contact
        i. Disconnect the orange lead from terminal 1.
        ii. Set ohmmeter to lowest range.
        iii. Check resistance between terminals 2 (red) and 5 (where the orange wire was connected).
        iv. If resistance is greater than 1 ohm, replace relay.

OVERLOAD TROUBLESHOOTING

1. Check motor amps

    a. Determine “true” amp (yellow) requirement of motor. This is listed on the schematic as “Pump Motor amps,” on a decal on the panel door as “Motor FLA” and in the ACI brochures.
    b. Power on control panel.
    c. Check all output leads to motor for proper amps.
    d. If amps are good, go to “Nuisance Tripping.”
    e. If amps are high, continue.

1-PHASE			3-PHASE		
HP	VOLTS	AMPS	HP	VOLTS	AMPS
1/2	115	12	1	208	6
1/2	230	6	1	230	5
1	115	16	1	460	3
1	208	11	2	208	9
1	230	10	2	230	8
2	208	14	2	460	4
2	230	13	3	200	12.5
3	208	20	3	230	10.9
3	230	18	3	460	5.5
5	208	30	5	200	20.5
5	230	28	5	230	17.8
7.5	230	15	5	460	8.9

TROUBLESHOOTING

OVERLOAD TROUBLESHOOTING

2. Check line-to-line resistance. Verify the power is off before testing.

    a. Power off control panel.
    b. Remove the pump cable connections from the terminal blocks at the bottom of control panel.
    c. Set the ohmmeter to lowest resistance range.
        i. Check each pair of pump cable wires, excluding Ground. Readings should be 2 – 20 ohms.
            1. Single Phase 3-wire: Black-Yellow < Red-Yellow < Black-Red.
            2. Single Phase 2-wire: T1-T2.
            3. Three Phase: T1-T2, T1-T3, T2-T3; all readings should be identical.
        ii. Readings of zero indicate a "Short"; readings greater than 20 ohms indicate an "Open" or partially broken line. Either of these readings indicate a problem.
    d. If line-to-line readings indicated a problem, it is necessary to isolate the problem.
        i. Any connection points, e.g. junction boxes, splices, connectors etc., provide a potential problem area. Additionally, animal bites, cuts or scrapes could create a problem.
        ii. Perform step# 2c at each connection point from the end of the cable at the control panel to the motor lead, until a good reading is found. The problem will be in the previous connection tested. If the final test is at the motor lead, the problem is with either the motor or the motor lead.
    e. If line-to-line readings are good, continue.

3. Investigate Mechanical Problems

    a. 70% of overload problems are mechanical e.g. worn or bad bearings, locked rotors, bent motor shafts, or broken shrouds. An improperly pitched prop, missing shims or nozzle problems may cause overloads to trip.
    b. When thrust bearings are worn, the motor shaft may be pulled 1/8" or more. When radial bearings are worn, the motor shaft may be moved side to side slightly.

4. Nuisance Tripping

    a. Nuisance tripping can be caused by temporary voltage irregularities e.g. brownouts, spikes.
    b. Excessive heat, above 122ºF may cause overload tripping. A control panel in direct sunlight will heat up and temporarily de grade thermal overloads protection. One possible solution is to remove the cover of the motor control box. Another solution is to cover the control panel with an awning or face the panel North or West.