Troubleshooting

There is not a single listing of motor trouble shooting procedures to be followed in a given order. The procedures will differ depending on the situation.

As with anything dealing with electricity, personal safety is of prime concern. Before you even touch the motor, MAKE SURE THE POWER IS OFF. Always turn the power off at the electric service fuse or breaker box. To prevent electrical shock, use a meter to check for electrical shorts and be sure the motor is securely grounded and bonded in conformity with local codes. Do not work on electrical devices if water or moist conditions are present and cannot be avoided.

If the motor is not operating properly, refer to the following:

Checklist

Motor fails to start (makes no sound)

- Check the obvious first. Are the power switch and timer on?
- Check for blown fuse or circuit breaker. If fuses are used be sure fuses are the proper size or type.
- WITH THE POWER OFF, check all connections on the terminal board. Verify they are correct by consulting the wiring diagram on the motor. Make sure all connections are tight including the ground wire.
- Check the voltage at the terminal board after first turning the power back on. Be sure to TURN THE POWER BACK OFF after completing this step. Note: Voltage at motor terminals should be + or – 10% of the voltage on the nameplate. If the voltage is high, contact the local Power Company. If the voltage is low check the wire size of the power line from the electric box to the motor.

- Check for overloading from other appliances on the same circuit as the motor.
- Inspect motor windings for continuity.
- Protector tripped – wait until the motor cools down then restart – check protector for continuity

Motor starts but shuts down (thermal overload protection)

- Check the voltage at motor terminal. If it is too high call the local Power Company.
- Check amperage. If high, find out if the pump impeller was recently replaced (it could be sized incorrectly). Remember, motor horsepower times the service factor = total horsepower. Total horsepower must be equal to or greater than the impeller rating. Check for overloads.

Noisy Motor

- Check motor coupling, brackets and other attached parts. Tighten loose nuts, bolts or set screws.
- Turn shaft. If it is rough or tight, check bearings
- Look for loose or binding parts inside the motor or the pump.
- Pump cavitation

Overheating (smoking or cycling)

- Check the motor's ventilation by looking for clogged air vents or openings. Clean away all dirt and leaves or other debris from around the motor.
- Check internal cooling fan. Is it intact and operating properly?

- Compare connections to wiring diagram. Make sure motor is connected correctly for applied voltage.
- Low or high voltage. Voltage should be + or – 10% of nameplated voltage. If it is higher that +10% call the local power company. If lower than –10% of the nameplated voltage check wire size from the service fuse box or circuit breaker. If the voltage is low from the service use a motor one increment higher in horsepower or an E-plus or Conservationist high efficiency motor of the same horsepower and service factor.

  TIP: *Electric demand on the power company varies. If the motor is nuisance tripping because of low voltage it may only trip during the part of the day when electrical usage is the highest. Do your voltage checks at that time of day.*

- High ambient temperatures. Pool motors are usually designed to operate in 50 degree C ambients (122 degrees Fahrenheit). Artificially high ambients can occur if a motor operates in a confined space and recirculates the same air or circulates air from another motor next to it.
- Check amp draw. If the amps are higher than nameplate amps but the voltage is acceptable, WITH THE POWER OFF, inspect the motor and the pump for mechanical obstructions that could cause an overload.
- Look at motor windings and capacitors for damage or signs of shorting. Check for continuity.
- Application overload. In cases of flooded suction or positive pressure on the inlet side of the pump, flow may be increased overloading the pump.

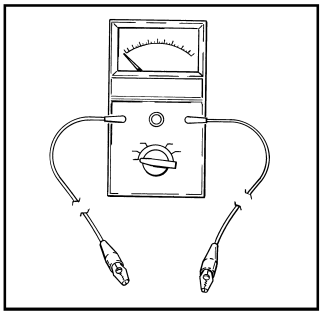
- Misapplication. Make sure the motor is not undersized. Remember that total horsepower is horsepower times service factor. The total horsepower must be equal to or greater than the pump/impeller rating.
- Check the motor start switch and governor (if applicable) to make sure it is adjusted properly and is operational.

Test Equipment

This section explains how to use test equipment.

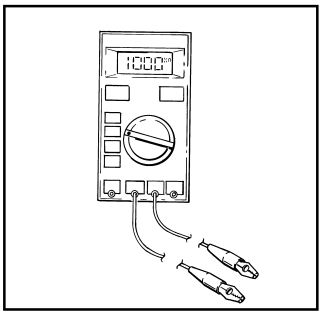
Conventional Multimeter or Ohmmeter

An ohmmeter can be used to measure the resistance of the various motor windings as well as to test the insulation. The ohmmeter will have numerous ranges from R x 1 where the meter reads directly in ohms, to a Rx100K where the actual meter reading must be multiplied by 100,000 for the actual ohm value.



Before using an ohmmeter:

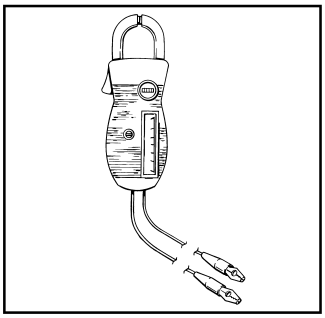
- Make sure the power is off.
- Read the instruction manual for the meter.
- All troubleshooting checks specify the ohmmeter range to be used. If your meter does not have the exact range, use the next higher range.



Digital Ohmmeter/Multimeter

Direct reading digital ohmmeters are readily available in the field. To use this type:

- Make sure the power is off.
- Read instruction manual for the meter.
- You do not have to set the ohmmeter to a particular scale as the meter displays the ohm value up to maximum capability of the meter.
- Install probes and take resistance readings in the normal manner.



Ammeter and Voltmeter

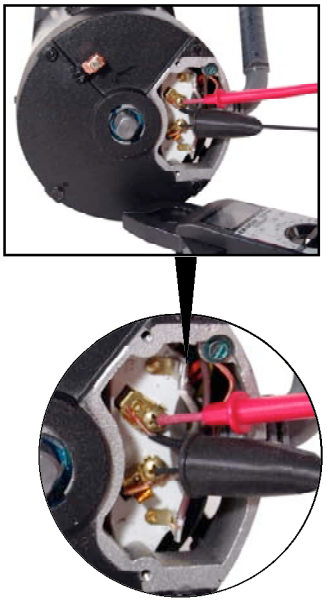
Voltmeter Readings:

Install leads in bottom of ammeter. Select the desired voltage scale. Take readings by touching one probe to each of the lead line terminals.

Ammeter Readings:

- Arrange leads so the jaws of the ammeter will encircle one lead.
- Set meter on maximum amp scale and encircle jaws around one lead and take reading. It may be necessary to reset to a lower scale.

Electrical Checks



Voltage Check

- Make sure power is off.
- Determine motor voltage and set meter
- Reconnect power
- Start the motor

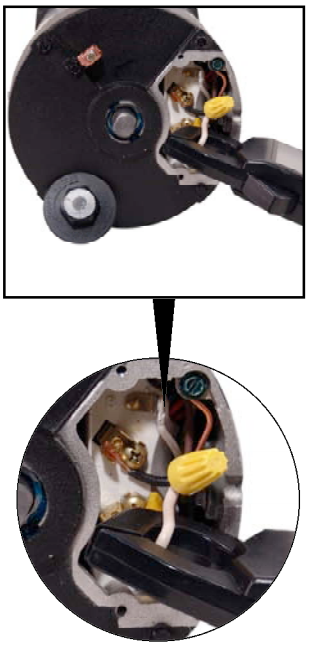
  Caution: All wires are live (hot) so use extensive care.

Touch one probe to L1 and the other to L2. Voltage reading to be within 10% of nameplate voltage, i.e. between 207 and 253 volts for a motor nameplated 230 volts.

If no voltage is recorded, check fuses, circuit breakers, timers, wiring, etc. for open connection or broken wires.

If voltage is outside the acceptable limits, check for adequate wire size. Look for loose terminals and connections or pitted contacts. Check pump disconnect switch.

Check voltage at service entrance. If not within plus or minus 10% contact power company.



Amperage Check

- Make sure power is off.
- Set ammeter scale based on Max. Load amps.
- Position one line lead (L1 or L2) so that the jaws of ammeter can encircle one power lead. (It will usually be necessary to install a test loop to have room for the meter jaws.)
- Make sure switch and governor are free of obstructions (if applicable).
- Reconnect power
- Start the motor

  Caution: All wires are live (hot) so use extensive care.
- Take a reading. The value should not exceed maximum load amps (service factor amps) on the motor nameplate.

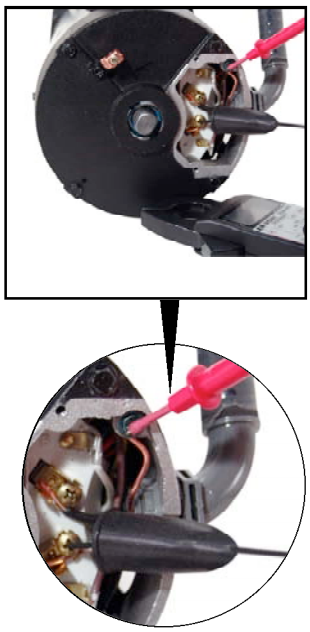
Excessive amps means an overloaded condition or incorrect voltage applied. Problem could also be a short in the motor.

Component Checks

Perform the following checks to confirm that each component is functioning properly.

Ground Check

- Turn the power off.
- Set ohmmeter to R x 1K.
- Attach one probe to ground screw on the end frame and touch the other probe to all terminals on the terminal board, switch, capacitor and protector. A reading of less than 10K could indicate a ground. New motors typically read over one megohm. Old motors with dust, dirt and moisture could show resistance to ground below 10K and still run satisfactorily. A cleaning may be in order. Readings may vary from day to day depending on humidity levels. Approximately 25K at 115 volts will trip the ground fault device. Keep in mind the ground fault device is seeing the total leakage of all loads on the circuit. GFI's normally trip on readings from 4 to 6 milliamps.
- If grounded, check all external leads for cuts, breaks, frayed wires, etc. Replace damaged leads and recheck for grounds and proper lead routings, Make sure replaced leads are not pinched between canopy or cover and end frame. If ground is in the stator, the motor must be replaced.



Start Switch Check (if applicable)

- Visual Checks
  1. Make sure power is off.
  2. Remove Canopy
- Discharge capacitor by touching the two terminals simultaneously with the blade of an insulated handle screwdriver.

- Make sure there are no obstructions preventing the proper operation of the rotating governor. Check wiring and make sure none of the leads are in the area of the governor where they can be cut or interfere with the governor. Check governor for proper operation and make sure flipper moves freely.
- Check switch contacts for severely burned or pitted contacts, sticking etc. Some blackening or pitting is normal after the motor has been used. Replace switch if there is any doubt. **DO NOT** try to repair the switch by bending the contact blades.
- The switch contacts in motors are plated and should never be sanded which would remove the plating and cause early failure. They may be cleaned by wiping the contacts with a piece of cardboard or paper bag.
- Attach one lead to each terminal of the switch. Ohmmeter reading should be 0. With one lead on each terminal, flip governor weight to the run position. Reading should be infinity.
- Reconnect power
- Start the motor. Visually check the action of the switch and governor. Switch contacts must be closed when motor is at rest and should open when the motor reaches about 2/3 of full load speed.

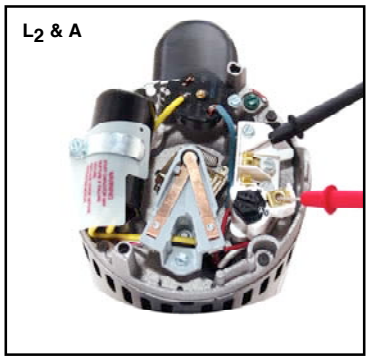
> **TIP**: *Replace the capacitor and switch at the same time. A defective switch usually stresses the start capacitor.*

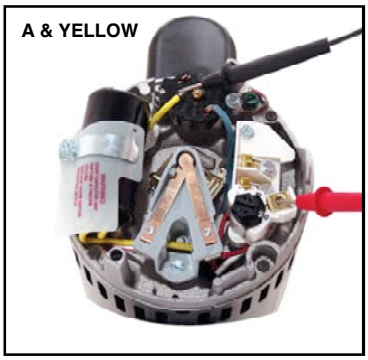
Winding Continuity

For typical two compartment, single phase, dual voltage only, capacitor start, single speed motor, connected for 230 volts. Set meter to R x 1.

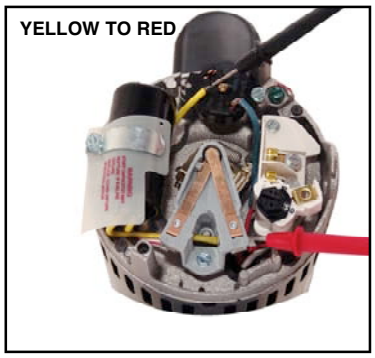
(For single voltage motors, check between L1 and L2.)

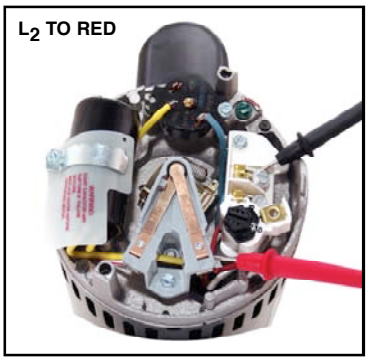
Disconnect one of the red leads to the switch. Discharge capacitor by shorting across the terminals with the blade of an insulated handled screwdriver. Take the following ohm readings.



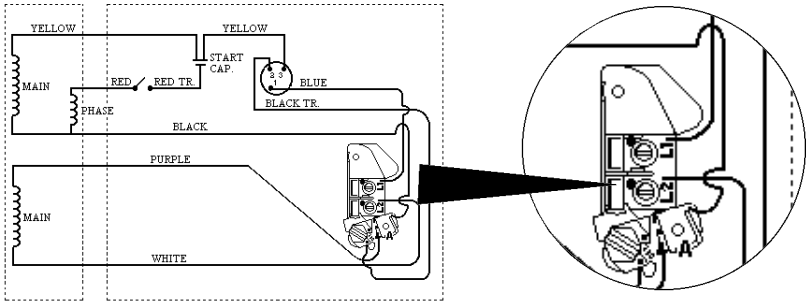


Resistance between L2 and A must be the same as resistance between A and Yellow.





Yellow to Red (winding side of switch) must be same as L2 to same Red terminal.



Protector (Thermal Overload) Check

- Set ohmmeter to R x 1.
- Resistance between terminals:

  1 & 2 should be approximately 0 (Disc.)

  2 & 3 should be approximately 0 (Heater)
- Replace if either value exceeds 1 ohm.

  TIP: *Motor cycling on overload indicates some other problem not just a defective overload.*

Capacitor Check (Start or Run)

- Set ohmmeter at Rx 1K.
- Slip a heavy piece of paper between points on the switch.
- Discharge capacitor by touching the two terminals simultaneously with the blade of an insulated handle screwdriver
- Attach one probe to each terminal. Ohmmeter needle should move rapidly to right then slowly drift to the left. (Low ohm reading to high ohm reading.)
- If digital meter is used, readings should start low and rapidly increase to maximum value.
- Replace capacitor if bad.

  TIP: *The replacement capacitor must be the same MFD as the original. However, if the same voltage rating is not available it is acceptable to use the next higher voltage. Example; if a 370 volt unit is not available, use the next rating, 440 volt.*