

## MOTOR TROUBLESHOOTING

### **WARNING**

Before you even touch the motor, **MAKE SURE THE POWER IS OFF**. Always turn the power off at the electrical service entrance fuse or breaker box, to prevent possible electric shock. To prevent electrical shock when touching the motor, be sure windings and capacitor are securely grounded to the ground terminal which should be used in conformity with local codes. Don't work on electrical operations if water or moist conditions cannot be avoided. If the motor is not operating properly, refer to the following guide.

### **MOTOR FAILS TO START (makes no sound)**

1. Check the obvious first — are the power switch and timer on?
2. Be sure fuses are of proper size and type, then check for a blown fuse or tripped circuit breaker.
3. Be sure the motor is connected correctly (as shown on motor nameplate), but first — **TURN OFF THE POWER**. Check the terminal screw to see if it was tightened onto wire insulation instead of the wire itself. Verify that the ground wire is firmly connected to the green ground screw.
4. Check the voltage at terminal board after first **TURNING THE POWER BACK ON**. Be sure you turn the **POWER BACK OFF** after completing this step.

**NOTE:** Voltage at motor terminals should be  $\pm 10\%$  of voltage on nameplate. If the voltage is high (more than  $\pm 10\%$  above nameplate number), consult the local power company. If the voltage is low ( $\pm 10\%$  below rated voltage), check the size of the power line from fuse box to motor. If the

voltage is within the proper range, check for continuity through the protector.

5. Check for overloading from other appliances on the same circuit as the motor.
6. Inspect the motor windings for continuity.
7. If voltage is proper at terminals and the motor is cold, remove the motor and take it to a A.O. Smith Authorized Service Center.

### **MOTOR FAILS TO START (hums, tries to start, blows fuse or trips breaker)**

1. Check the motor connections after **TURNING OFF THE POWER**.
2. Check the voltage (see #5 above) as the motor tries to start. If voltage is too low, look for undersized wiring, an overloaded circuit or a burned start winding.
3. If the voltage is proper at terminals and motor is hot, **TURN OFF THE POWER** and allow the motor to cool to ambient temperature then reapply power. If the motor starts then shuts down, you have an overload. Check the amp draw at the motor terminal and compare it to amps shown on the motor nameplate. If the amp draw is greater than the nameplate current, check for impeller rub in the pump or a tight seal. If this fails to correct the problem, remove the motor from pump and take to a A.O. Smith Authorized Service Center.
4. Check the capacitor but first — **TURN OFF THE POWER**. After removing the capacitor from the motor, discharge it by laying an insulated screwdriver across its terminals. Check the

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capacitor using an ohmmeter (see “Troubleshooting A Capacitor” page 23).

5. Rotate the motor shaft. If you hear a grinding sound, disassemble the motor and check: the conditions of bearings, a rotor rubbing the stator, corrosion, a cracked frame, clogged fan or obstruction(s). Repair or replace any faulty part(s).
6. If the motor has a switch, disassemble the motor and check the contacts for dirt. Use brown Kraft paper to gently clean. If the motor still doesn't work, replace the switch.
7. If the switch contacts are open, check the governor for free movement on the shaft. (Incidentally, with a Centurion motor you won't have this problem, because it doesn't have a switch to malfunction.)

### **MOTOR STARTS BUT SHUTS DOWN (Thermal Overload Protection)**

1. Check the voltage at motor terminal (see #5 under “Motor Fails To Start”). If the voltage is too high, call power company.
2. Check amperage. If high, find out if the pump impeller was recently replaced (it could be sized incorrectly). Remember, motor Hp x SF = the maximum Hp capability of motor. This number must be equal to or greater than the pump rating.

### **NOISY MOTOR**

Air noise is normal, but an excessively high sound level or rough operation can mean trouble. If necessary, separate the motor and pump to find out where the fault lies. If it's in the motor, check the following items:

1. Mounting, motor coupling and brackets. Tighten loose nuts, bolts or set screws.
2. If a noticeable drag is present, check the bearings and bearing load spring.
3. Make sure motor fan moves freely and rotor isn't rubbing stator. Look for loose or binding parts inside the motor or pump.
4. Check for malfunctioning motor start switch and governor.

If the problem appears to be with the pump, look for a loose motor coupling, loose or damaged pump impeller, clogged pump filter or strainer, or cavitation (loss of prime or air leaks on the pump's suction side).

### **MOTOR HOT, SMOKING OR CYCLING**

1. Check the motor's ventilation by looking for clogged air vents or openings. Clean out all leaves, dirt and other pool and spa gunk.
2. Compare connections and wiring to diagrams. Test the motor voltage to verify that it's within  $\pm 10\%$  of nameplate listing.
3. If the voltage checks out but amps are higher than the maximum on the nameplate, inspect motor and pump for mechanical obstructions, but not before **TURNING OFF THE POWER**.
4. Ensure that the motor's horsepower (Hp), times the service factor (SF), is equal to or greater than the pump rating ( $\text{Hp} \times \text{SF} \leq \text{to Pump Rating}$ ). A full-load current greater than the nameplate listing can mean excessive pump load.
5. Look at motor windings for damage or signs of shorting. Measure winding resistance.

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6. Check the start switch for broken contact welds or a broken spring.
7. Check the capacitor with an ohmmeter. A bulged capacitor indicates failure on most motors. But with a Centurion, the only way to verify a failed capacitor is with the ohmmeter.

### INFORMATION NEEDED FOR MOTOR REPLACEMENT

To get the right replacement motor, you'll need important information. Fortunately, they all can be found on the motor nameplate. Here's what you'll need to know:

1. Mounting configuration - C-Bracket, Square Flange, or Through-bolt Mount (See page 5-7).
2. Horsepower
3. Service factor
4. Voltage
5. Pump part number, manufacturer brand name

### TROUBLESHOOTING A CAPACITOR

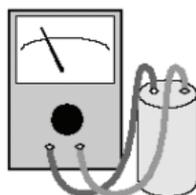
To check a capacitor with an ohmmeter, first **TURN OFF THE POWER**. If possible, remove the capacitor from the motor.

Use an insulated screwdriver to discharge the capacitor by shorting it across its terminals.

Then set the ohmmeter to its highest setting and attach the ohmmeter's clips to the capacitor's terminals.

Check for the following indications:

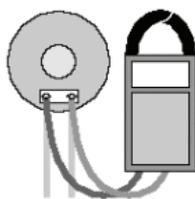
1. Needle drops to zero range and slowly rises — capacitor is probably OK.
2. Needle drops to zero and stays there — capacitor most likely is shorted.
3. Needle remains at a high value — capacitor may have an open circuit.



## BEST WAY TO USE A VOLT-AMMETER

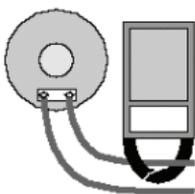
### For Voltage Check

1. Attach leads to the volt-ammeter and select the proper voltage scale
2. Test voltage at the motor line terminals and verify that it's within limits while the motor is operating.
3. Voltage should be within  $\pm 10\%$  of the design voltage specified on the motor nameplate.



### For Amperage Check

1. Remove the leads from the volt-ammeter if attached. Select lowest reading amperage scale according to motor nameplate rating.
2. Clamp instrument around one incoming lead at the motor terminal board.
3. Observe the amperage as motor runs. With proper voltage, the reading should not exceed the **MAXIMUM LOAD** or SF amps rating of the motor.



## HOW TO REPLACE BEARINGS

Replacing the bearings in a motor isn't a difficult task, provided you follow set procedures. These instructions explain the correct method of motor bearing removal and replacement. If a bearing is noisy or doesn't run smoothly, it should be replaced. If a bearing has been removed for any reason, it should be replaced with a new one. As a rule, if it's necessary to replace one bearing, replace the other as well.

Use only A.O. Smith bearings with the proper part number for the motor that you're working on. A.O. Smith bearings are lubricated and require no further attention during their life. Do not substitute or reuse old

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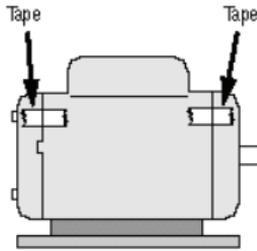
bearings because this could damage the motor and cause a return service call.

## 1. TURN THE POWER OFF

2. Remove the cover from the motor and disconnect the electrical supply leads from the terminal board. Then remove the electrical cable or conduit from the end frame.

3. Remove the motor from the pump unit.

4. Mark the brackets and frame of the motor, to assure correct alignment of these parts when reassembling them.



5. Remove the rotor and shaft from the frame of the motor, following these steps as necessary:

a) Take out the thru-bolts that secure the brackets to the frame.

b) Remove the bracket opposite the shaft by placing a screwdriver blade in the notches of this bracket and tapping the handle of the screwdriver.

c) Remove the locking collar screws and washers if their use prevents removal of the rotor assembly from the shaft end bracket.

d) Carefully pull the shaft/rotor assembly out of the shell or stator toward the shaft extension end.

e) Be careful not to lose the washer and bearing load spring that is positioned in the bottom of the bearing bore of the bracket opposite the shaft extension. Be sure to replace this spring during reassembly.

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- 6.** Remove the bearing(s) from the motor shaft, following these steps as necessary:
    - a)** Remove shaft collars used to secure bearings. Don't reuse a bearing that is removed from the shaft.
  - 7.** Install the new shaft bearing(s). It is important to press only on the bearing inner race. The bearing will be damaged if the outer race surface is pressed.
    - a)** Fan end. Place the short end of the shaft on a wood block. Place the bearing (and other parts used) over the long end of the shaft. Tap the bearing into place, using the proper size tube and a mallet. Attach any other parts (as used) to the long shaft end.
    - b)** Opposite end. Place the long end of the shaft on the wood block. Place the bearing over the short end of the shaft. Tap the bearing into place, using the proper size tube and a mallet.
  - 8.** Reassemble the motor in reverse of the disassembly procedure.
    - a)** Observe all reassembly precautions.
    - b)** Check wiring diagrams to assure proper wiring if the leads have been removed from the terminals.
    - c)** **TURN ON THE POWER.** Check the motor for proper electrical and mechanical operation when it has been reinstalled.