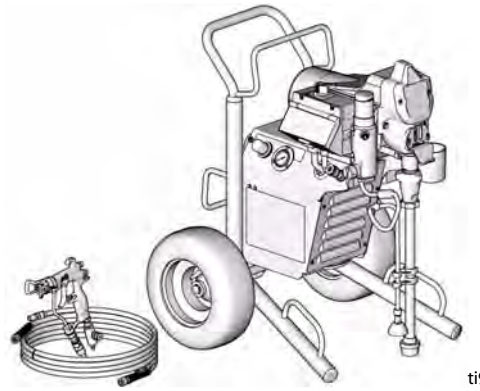
FinishPro™ 390/395 Airless/Air-Assisted Sprayer Repair Electrical Manual

GRACO

First choice when quality counts. ™

Rev. B 10/11 /07

FinishPro 395



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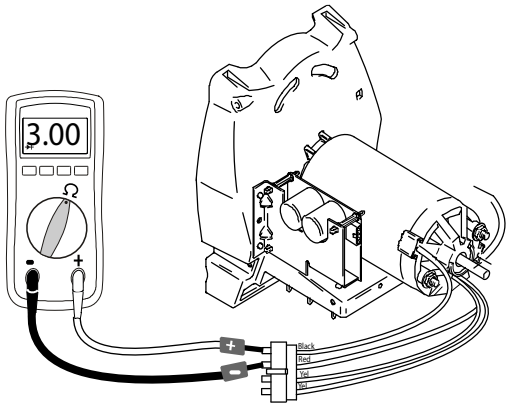

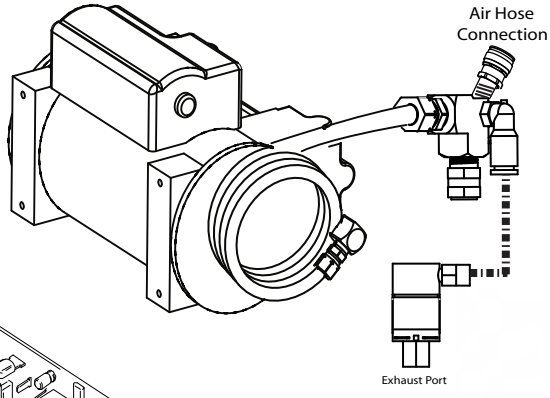

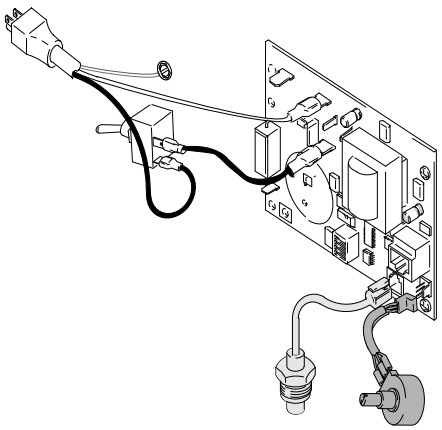

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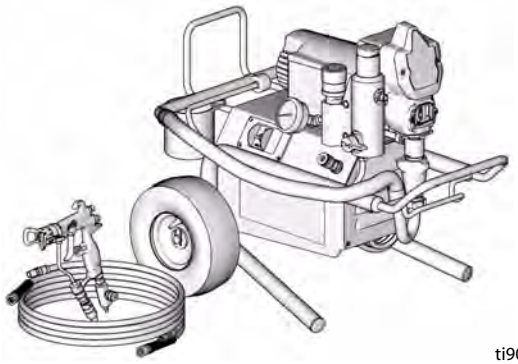

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⚠ WARNING

This manual should only be used by a qualified Service Technician.

Table of Contents

BASIC ELECTRICAL TERMINOLOGY

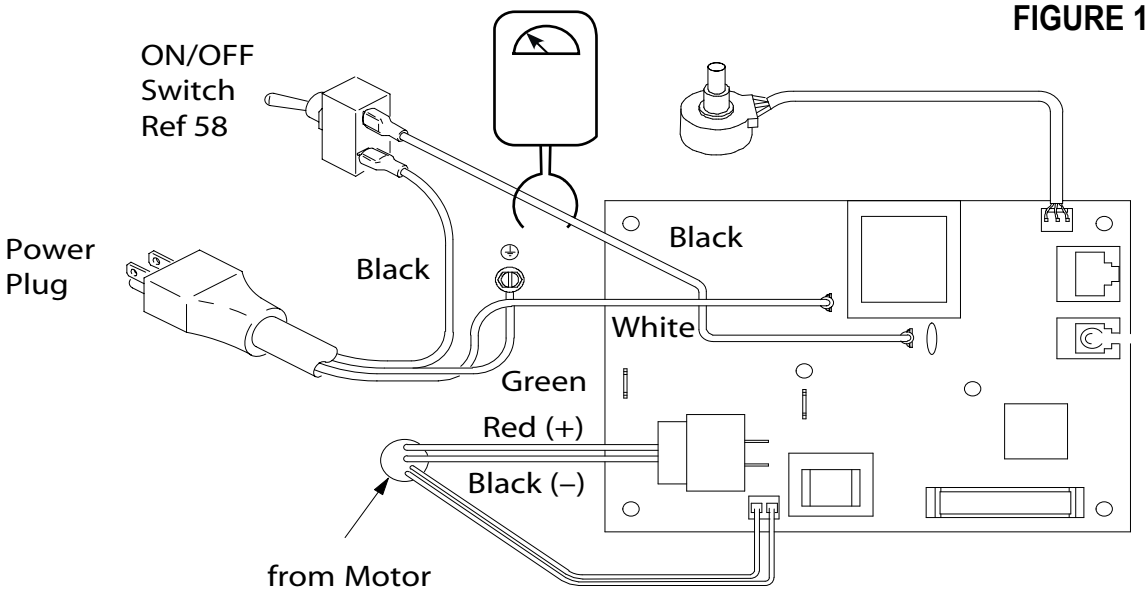
In any discussion of electricity, there are three basic terms you will need to understand.

CURRENT
VOLTAGE
RESISTANCE

CURRENT:

Current is the movement of the electrical charge.
Current Flows through the wires from the power source to the load.
Current is measured in AMPERES (AMPS, A or I). **See Figure 1.**
NOTE: Meter is only clamped around one wire.

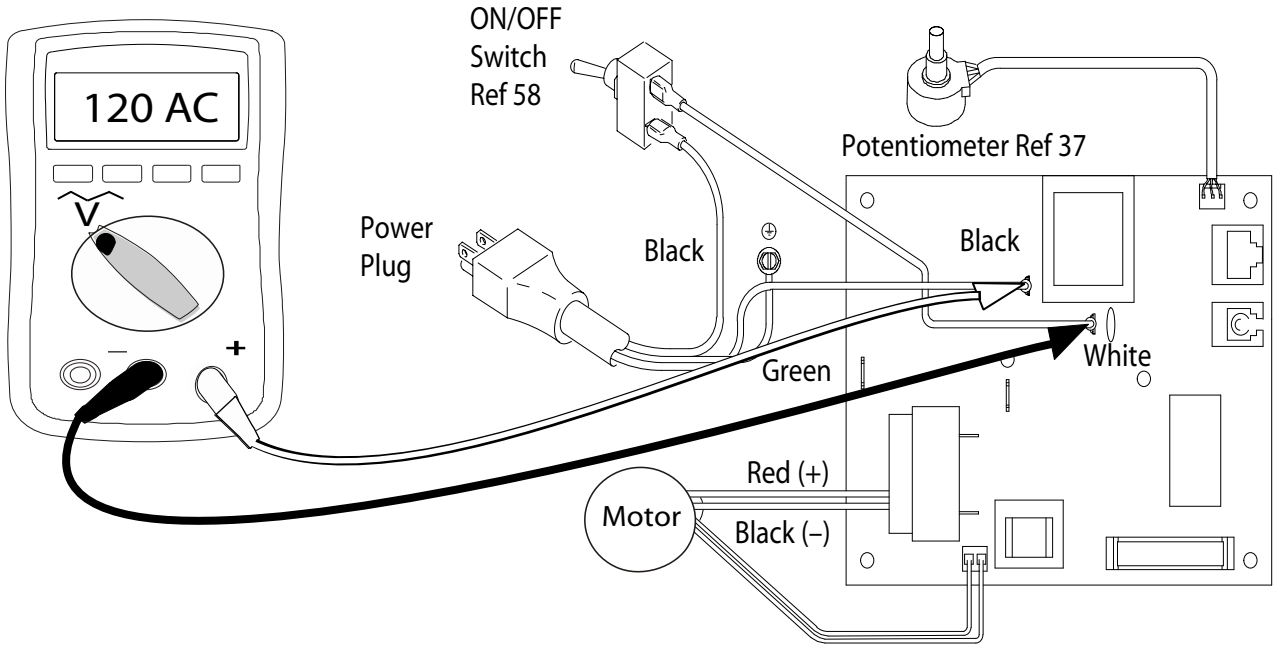
FIGURE 1



VOLTAGE:

Voltage is the force that causes current to flow in a circuit.
Voltage is measured in VOLTS (V or E). **See Figure 2.**

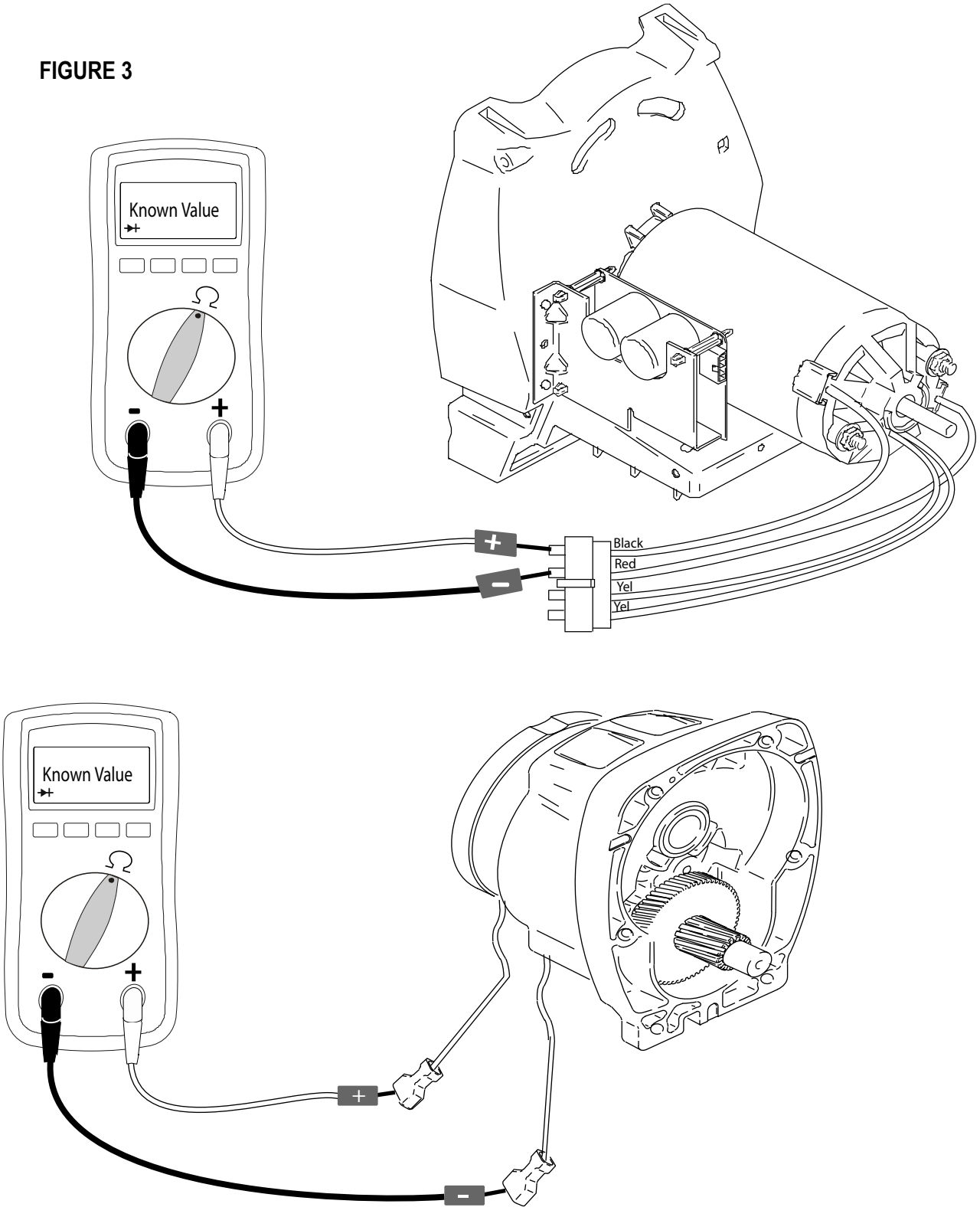
FIGURE 2



BASIC ELECTRICAL TERMINOLOGY

RESISTANCE:
Resistance is anything that causes an opposition to the flow of current in a circuit.
Resistance is used to control the amount of voltage and/or amperage in a circuit.
Resistance is measured in OHMS - Ω. **See Figure 3.**
A common component check would be motor and clutch field windings.

FIGURE 3



CONTINUITY TESTING

Checking “continuity” is one of the most common tests in electrical troubleshooting. Continuity is the ability of a wire or electrical component to conduct current. When you use a continuity tester, you connect a circuit (the continuity tester) that you know works, to a wire or a component that may or may not work. The continuity tester will tell you if the wire or component is capable of conducting current.
Continuity testers are available at almost any hardware store.

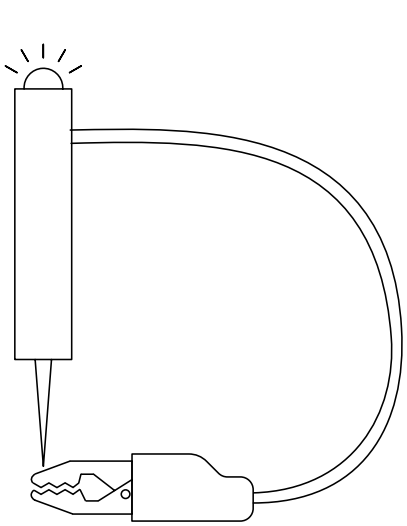
A volt-ohmmeter or VOM can also be used to check continuity. This meter can be purchased at most electrical or electronic supply stores.

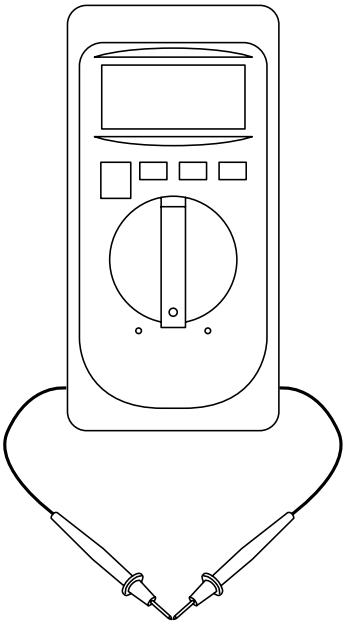
To test a component for continuity:

1 Check the tester by connecting the leads.

* If using a test light the light should turn on.

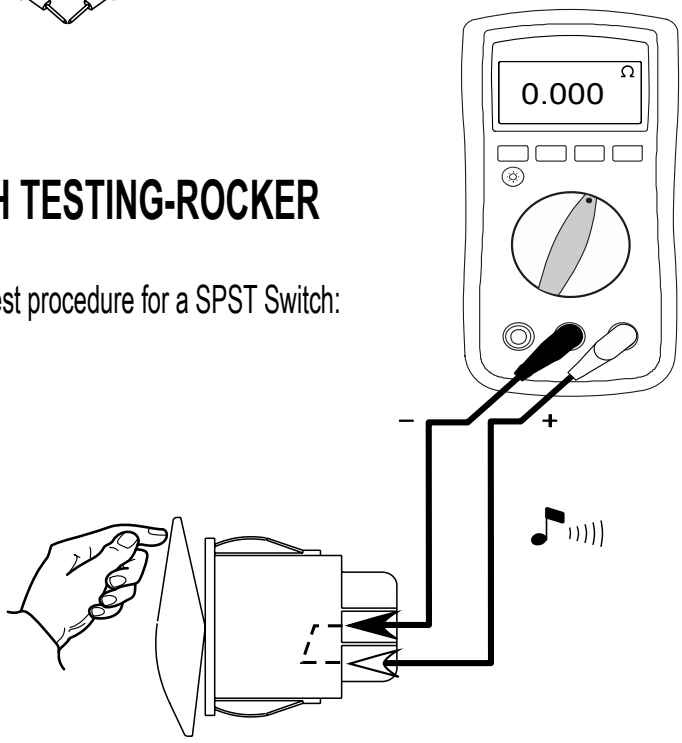
* If using a digital volt-ohmmeter, the screen should show 00 if OL appears the meter needs to be repaired.





SWITCH TESTING-ROCKER

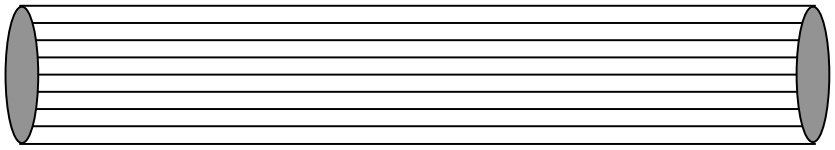
Common test procedure for a SPST Switch:



WIRE CONTINUITY TESTING

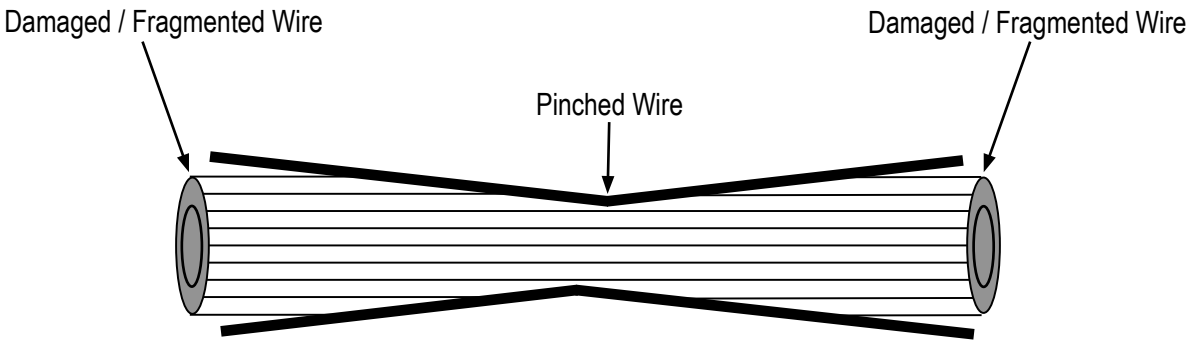
Continuity testing will "NOT" find wire fragmentation!!

Example:



120 Vac input static voltage and drops to 119Vac load voltage.

A good piece of wire will carry line and load voltage.



120 Vac input static voltage and drops to 76Vac load voltage.

Other causes:
Poor stripping of outer insulation.
Poor crimp.

A defective piece of wire may carry line voltage but will "NOT" carry load voltage

GROUND TESTING

Improper installation or alteration of grounding plug could results in risk of electric shock, fire or explosion that could cause serious injury or death. The other function of the grounding plug is to protect the control board from static build up. If the plug is missing this could cause permanent damage to the control board.

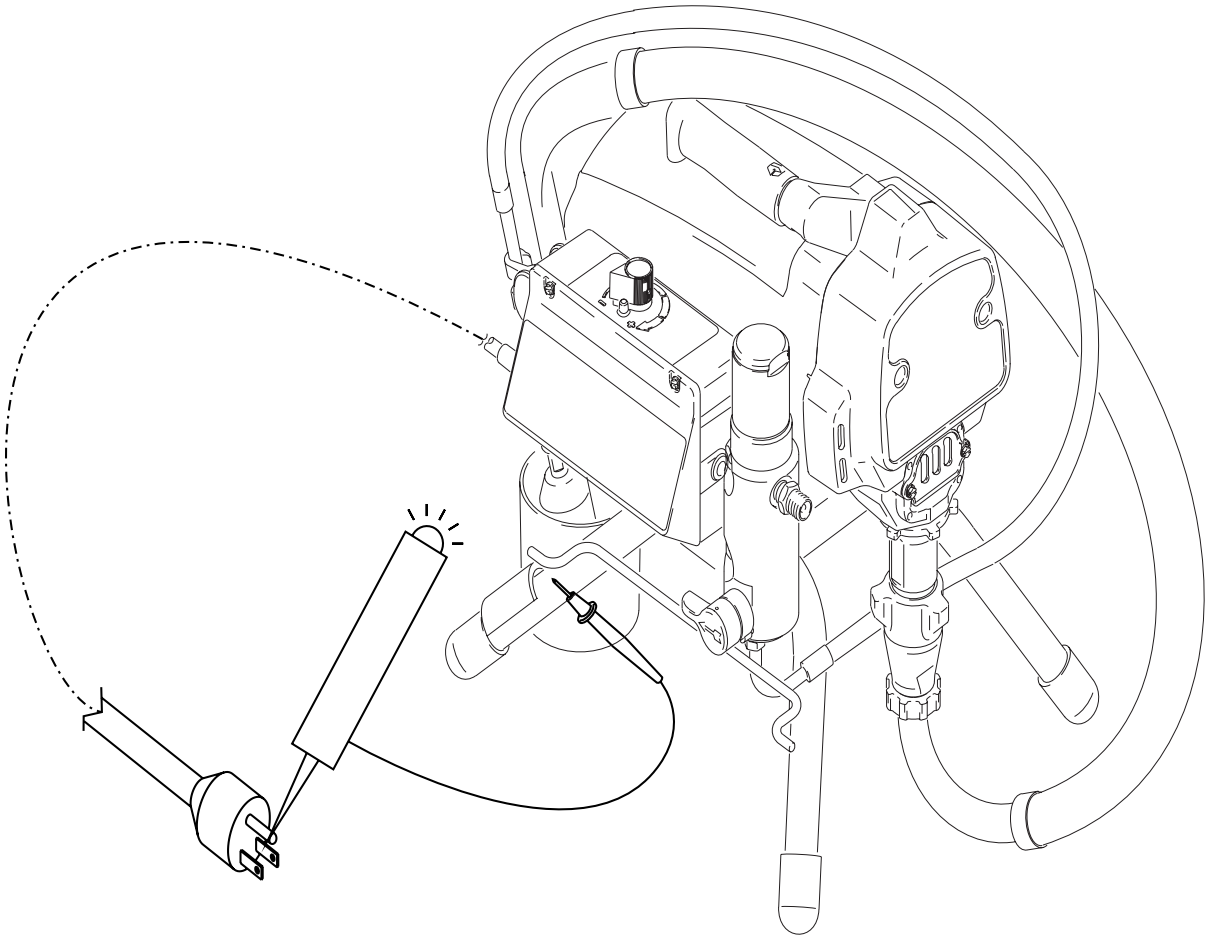
Every corded electric sprayer that comes into your shop for repair should be tested as described below, to make sure that it is properly grounded.

Pull the machine's plug out of the wall outlet and connect one lead from a DC continuity test light or a VOM to the (round) ground terminal on the plug.

NOTE:

If the ground terminal is broken off of the plug, install a new plug.

Touch the test light (or VOM) leads to several bare metal surfaces on the body of the machine. If the light (or meter) indicates continuity, the machine is properly grounded. If the light (or meter) doesn't indicate continuity trace through the ground (green) wiring on the machine to determine where the break is.



CAPACITOR TESTING:

A capacitor is an electrical component that stores electricity. Capacitors are usually used to help start a motor or make a motor run more efficiently.

The following instructions can be used to test any capacitor.

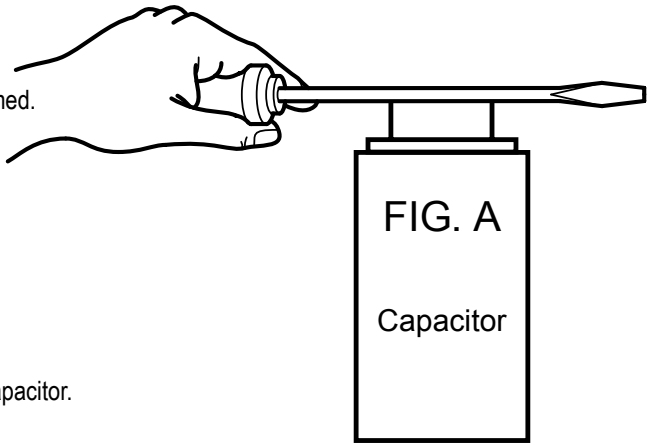
⚠ WARNING!

A CAPACITOR CAN SHOCK YOU EVEN WHEN A MACHINE IS UNPLUGGED. NEVER TOUCH CAPACITOR TERMINALS WITH YOUR FINGERS. ALWAYS USE TOOLS WITH INSULATED HANDLES. NEVER DISCHARGE A CAPACITOR NEAR FLAMMABLE LIQUIDS OR VAPORS.

1 Visually inspect the capacitor for leaks, mechanically damage or loose terminals. Replace it if any of these problems exist.

2 Unplug the machine and remove the capacitor(s).
If capacitor(s) are attached to the control board the test can not be perormed.

3 "SEE ABOVE WARNING" Using a screwdriver with insulated handles, hold so that the blade contacts the capacitor terminals as shown in Fig. A. This will "discharge" the capacitor.



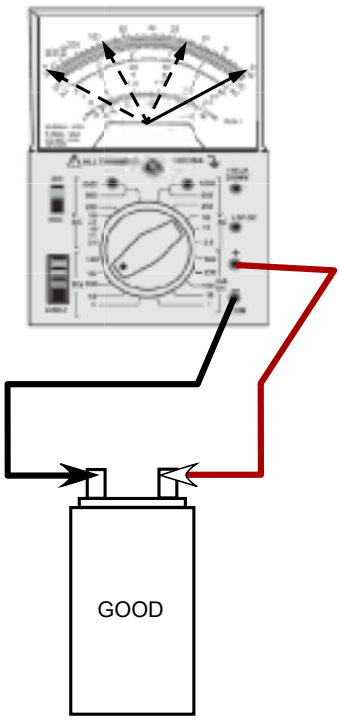
4 Put a volt-Ohm meter on the R X 100 scale.

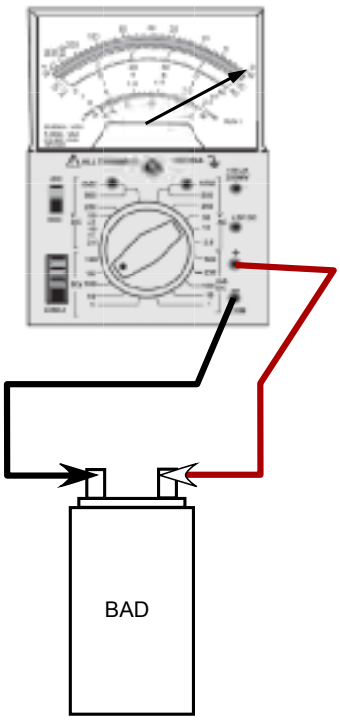
5 While watching the meter, connect the 2 leads to the 2 terminals on the capacitor.

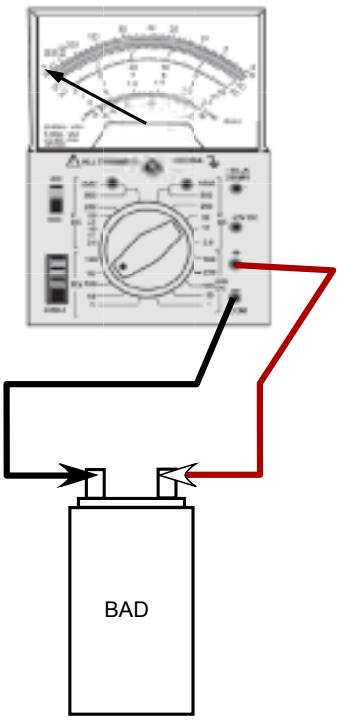
➢ If the capacitor is good, the meter needle will go to the right (toward 0 resistance) (Fig. 1), then to the left (toward - maximum resistance)

➢ If the meter needle goes all the way to the right and stays there, the capacitor is defective.(Fig.2)

➢ If the meter needle stays all the way to the left (doesn't move at all when connected to the capacitor), the capacitor is defective.(Fig. 3)





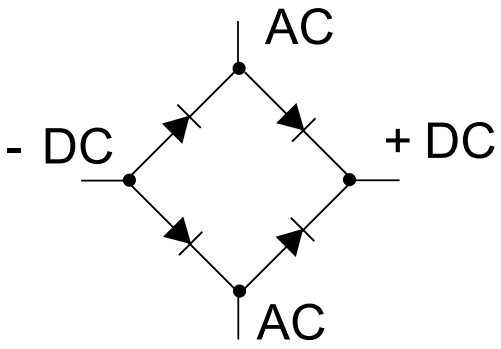


RECTIFIER

(See Fig. 1) Now we come to the most popular application of the diode: rectifcation. Rectifcation is the conversion of alternating current (AC) to direct current (DC). This almost always involves the use of some device that only allows one-way flow of electrons. As we have seen, this is exactly what a diode does.

RECTIFIER TESTING:

FIG. 1



The following instructions can be used to test any bridge rectifer.
Use a DC continuity test light or a VOM (on the R x 100 scale) for all tests.

Disconnect all wires from the rectifer.

1 Connect test leads as shown in Figure A. If the meter beeps, the rectifer is defective. If the meter does not beep, go to the next step.

2 Connect test leads as shown in Figure B. If the meter does not beep, the rectifer is defective. If the meter beeps, go to the next step.

3 Connect test leads as shown in Figure C. If the meter beeps, the rectifer is defective. If the meter does not beep, go to the next step.

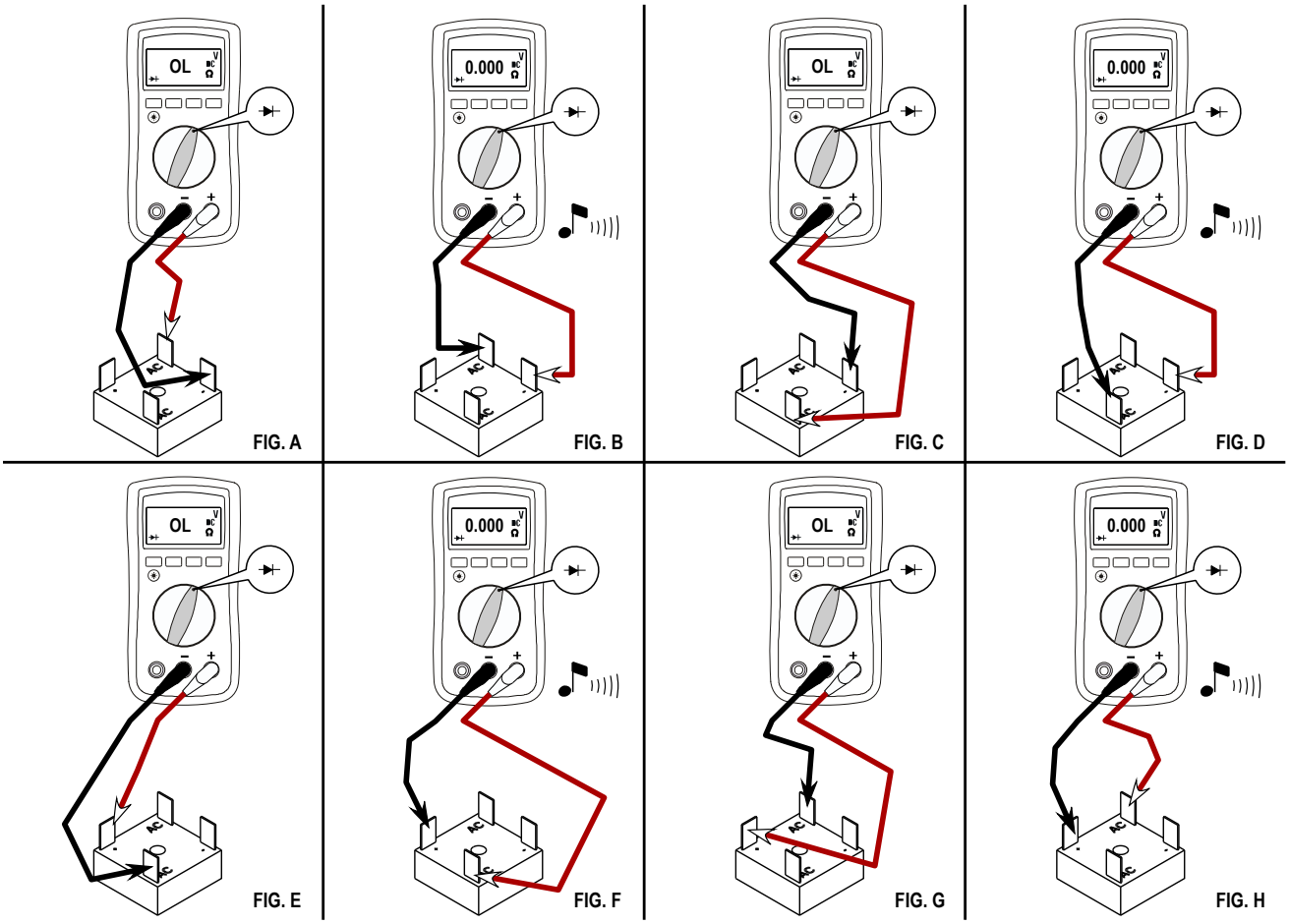
4 Connect test leads as shown in Figure D. If the meter does not beep, the rectifer is defective. If the meter beeps, go to the next step.

5 Connect test leads as shown in Figure E. If the meter beeps, the rectifer is defective. If the meter does not beep, go to the next step.

6 Connect test leads as shown in Figure F. If the meter does not beep, the rectifer is defective. If the meter beeps, go to the next step.

7 Connect test leads as shown in Figure G. If the meter beeps, the rectifer is defective. If the meter does not beep, go to the next step.

8 Connect test leads as shown in Figure H. If the meter does not beep, the rectifer is defective. If the meter beeps, the rectifer is good.



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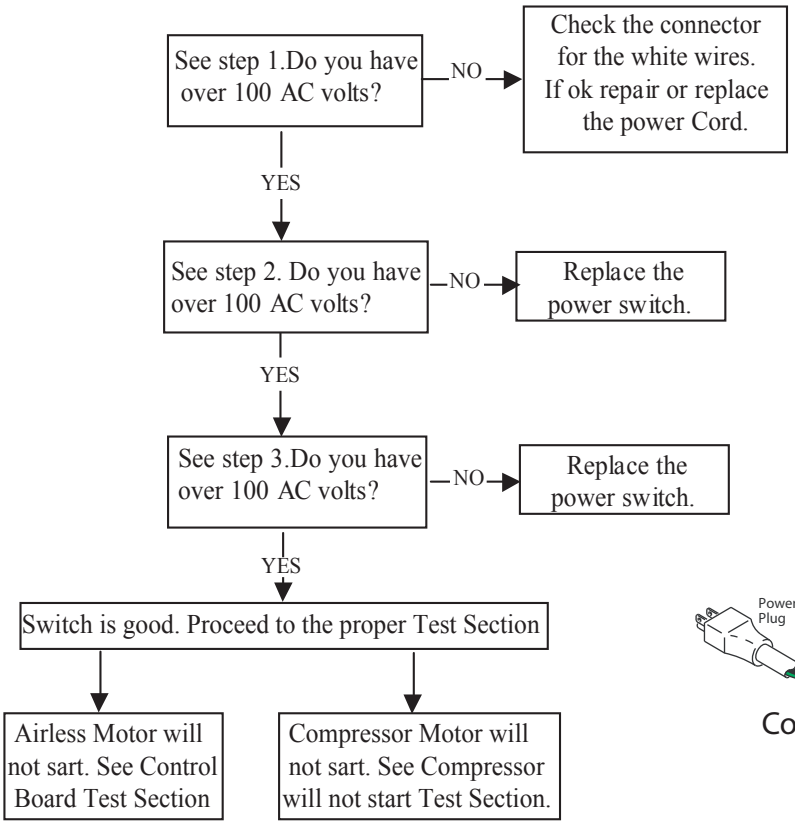
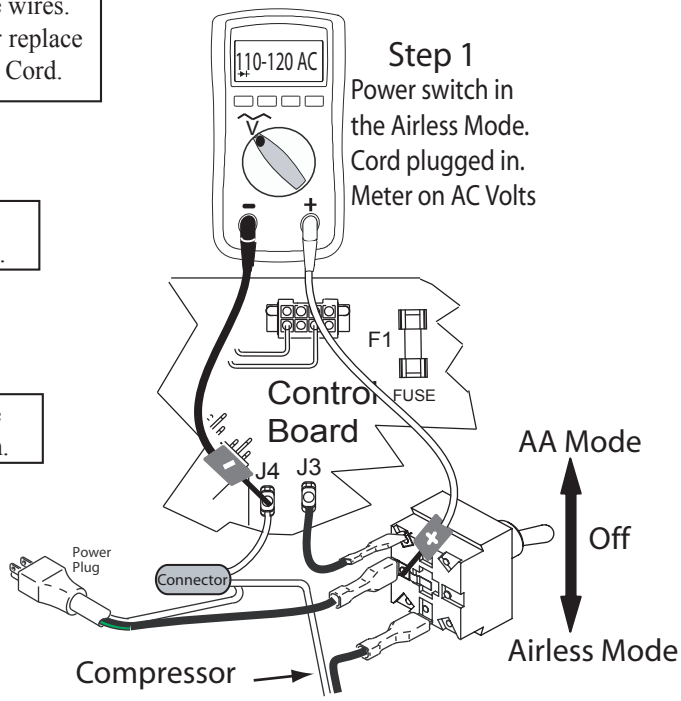
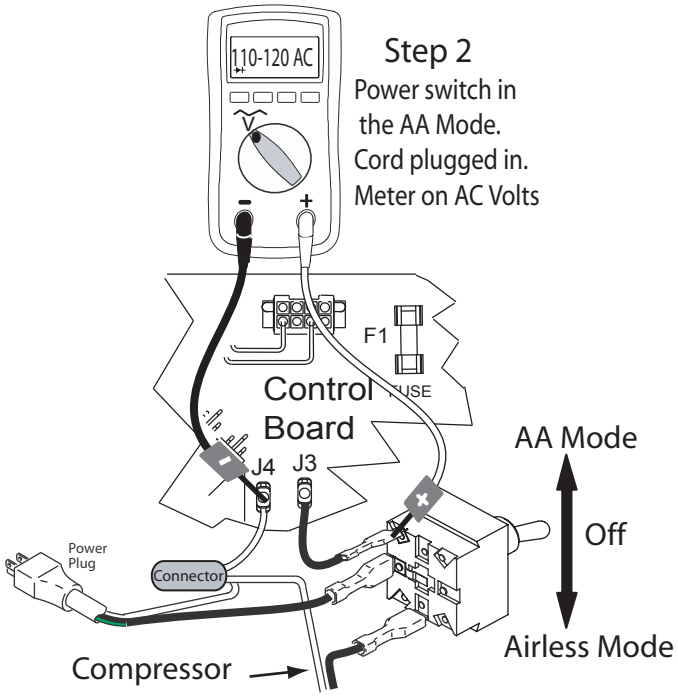
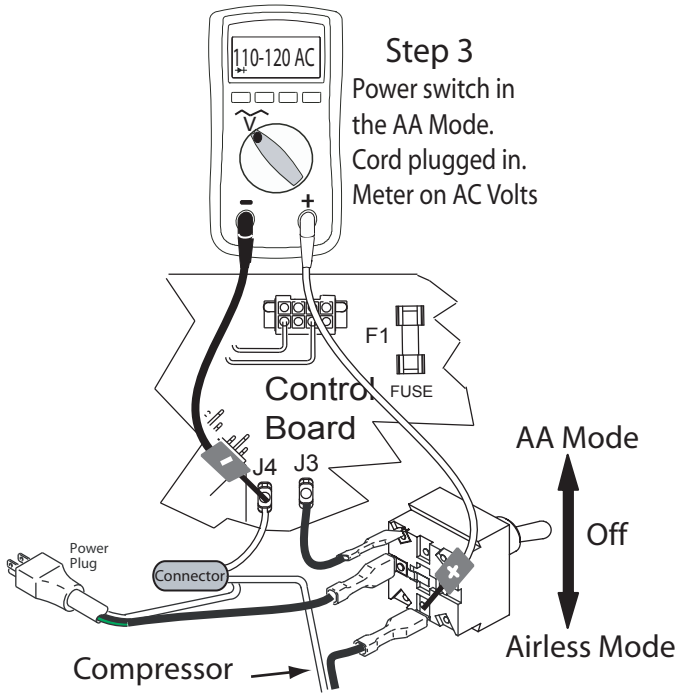
ON/OFF Switch Test





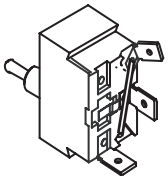


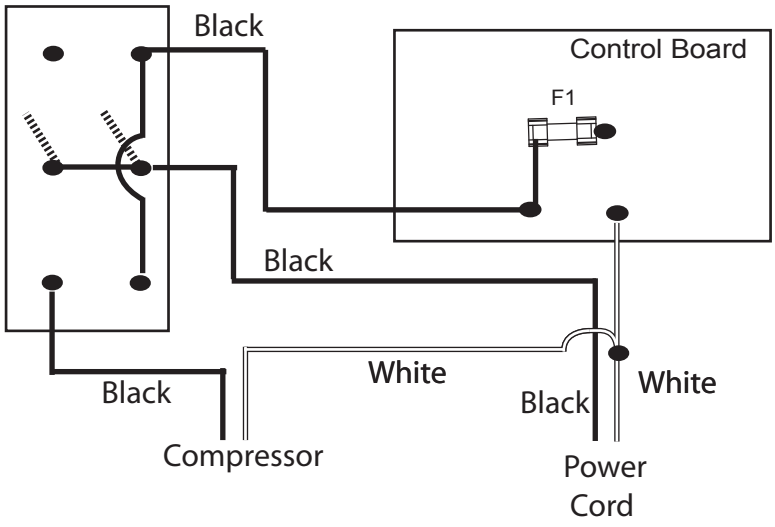


FinishPro™ 390 Switch Ladder Diagram

OFF

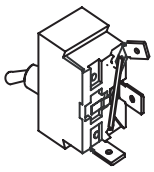
Off
Switch Center

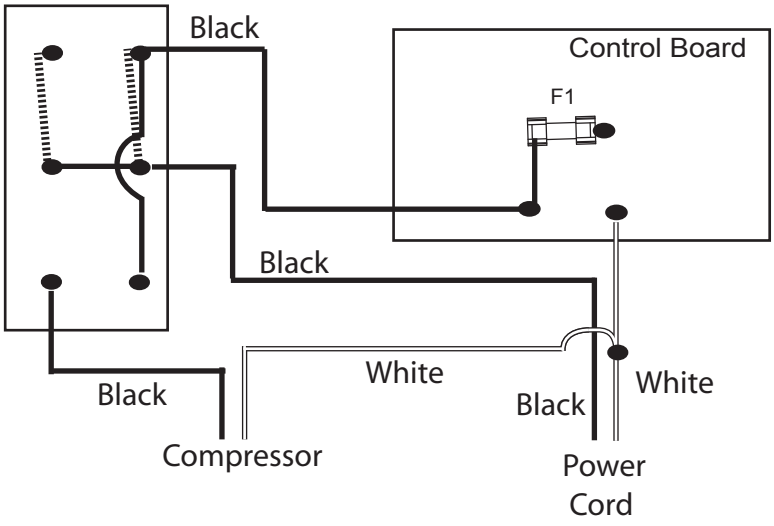




Airless

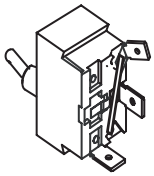
Airless Mode
Switch Down

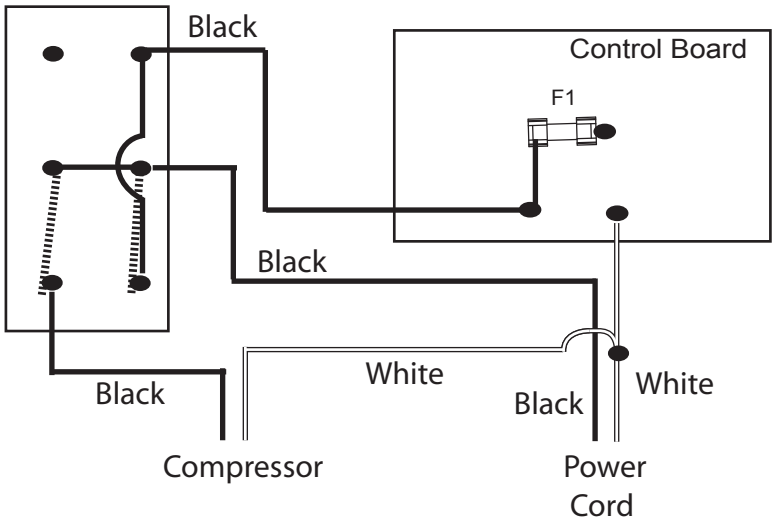




Air-Assisted

Air Assisited Mode
Switch Up





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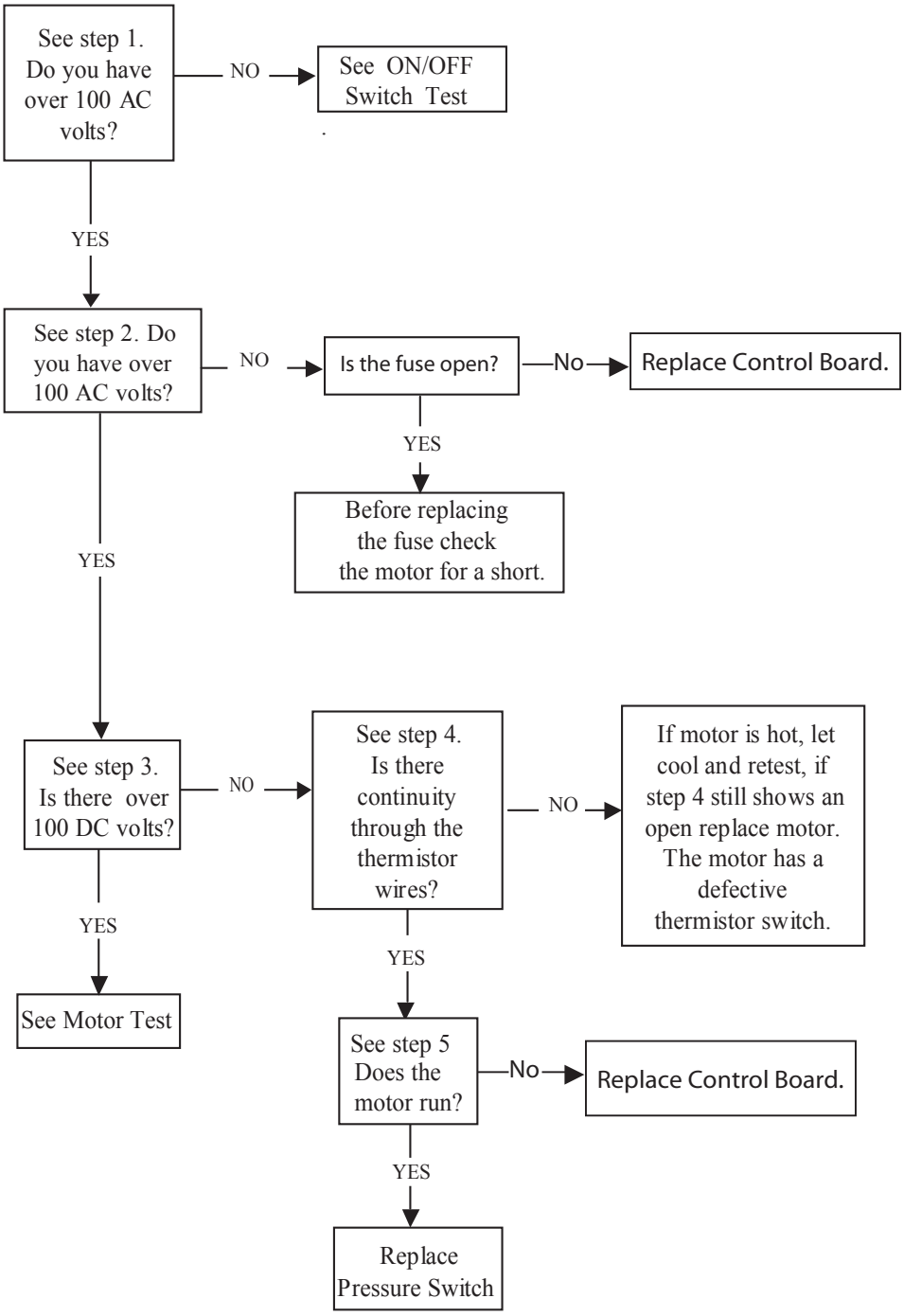
288841 Control Board

Airless Motor will not run

See pages 12 for the steps and illustrations.



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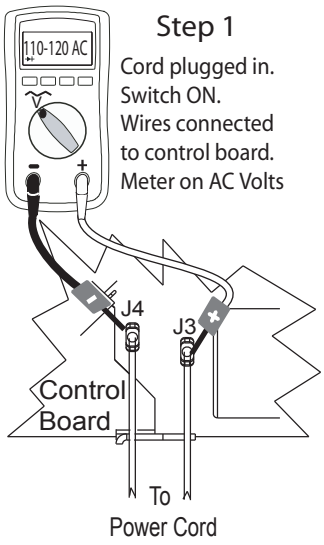
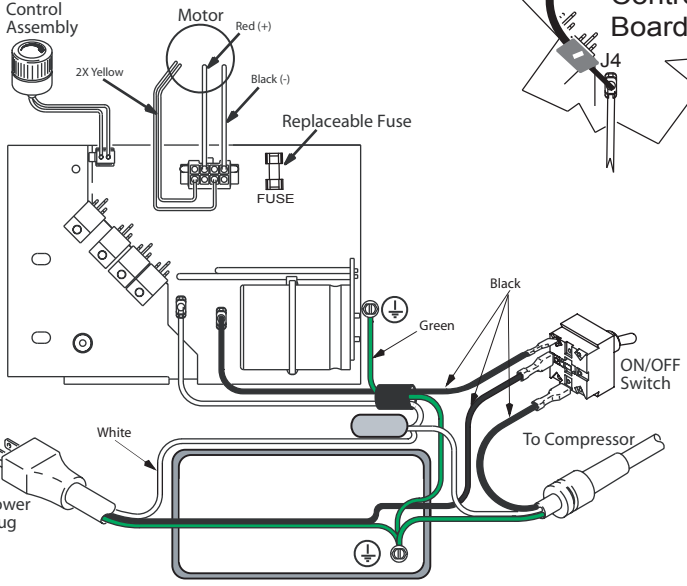
261779 Control Board

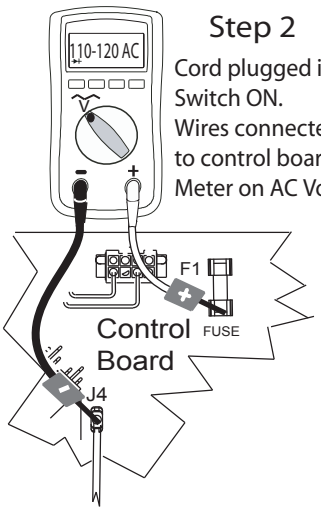
Airless Motor will not run



Step 1

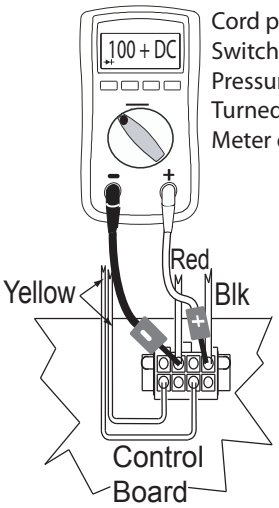
Cord plugged in.
Switch ON.
Wires connected to control board.
Meter on AC Volts





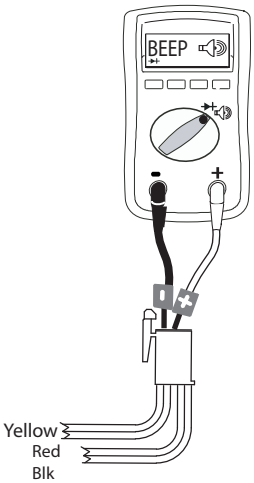
Step 2

Cord plugged in.
Switch ON.
Wires connected to control board.
Meter on AC Volts



Step 3

Cord plugged in.
Switch ON.
Pressure Switch Turned to high.
Meter on DC volts.

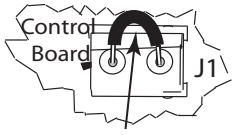


Step 4

Checking the motor thermistor switch .
Unplug the motor wires from control board.
Carefully insert the meter probes into the 2 yellow wires.
Meter should read continuity.
Note: motor should be cooled down.

Step 5

Motor plugged in.
Cord plugged in.
Switch ON.
Pressure switch unplugged.



Insulated Jumper wire stripped on the ends

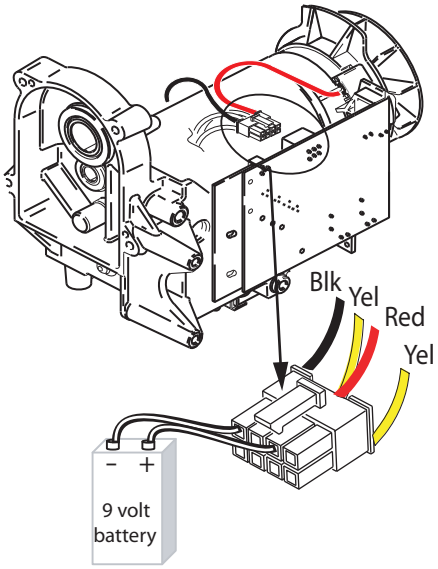
249040 Motor Test

1. Remove the pump pin and try to run the sprayer.If the motor runs check for locked or frozen pump or drive train. If sprayer does not run, go to next step.
2. Set sprayer to OFF and disconnect power to sprayer .
3. Disconnect motor connector from control board. Check the motor connector and control board contacts. They must be clean and secure. Reconnect motor connector to control board socket(s). Turn the pressure knob clockwise a ½ turn. Try to restart the motor. If motor does not run follow the steps below.

Use CAUTION not to distort the connectors when inserting the meter probes.

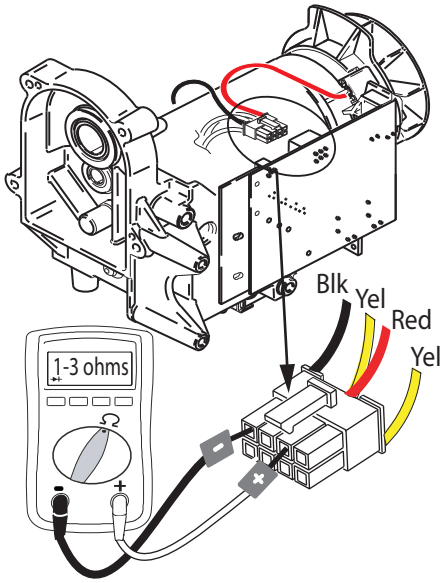
Step 1

Perform a spin test by connecting a 9 volt battery or larger to the motor leads.



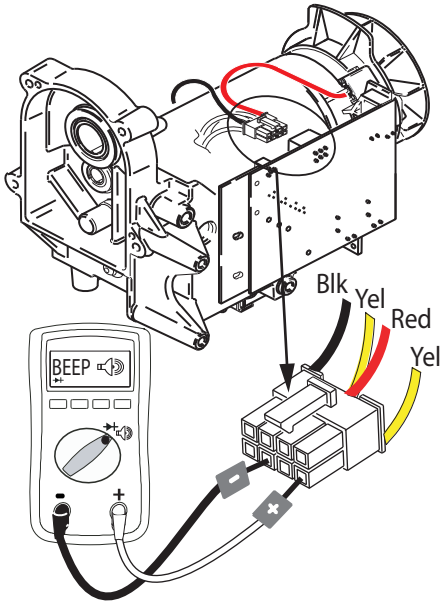
Step 2

Spin the motor while checking.
If a open is found replace the motor.



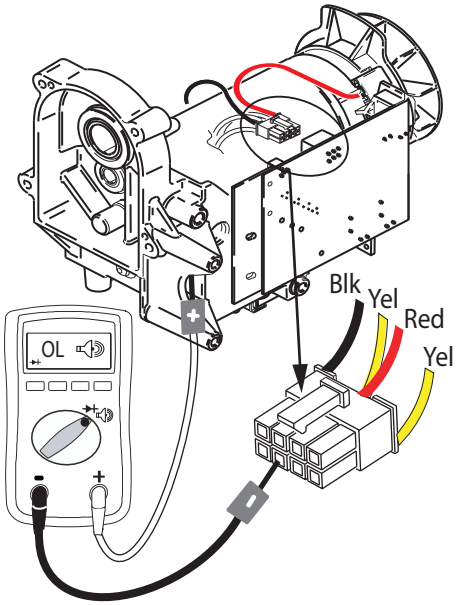
Step 3

Checking the motors thermal protection.
Meter should read continuity.
Note: motor should be cooled down.



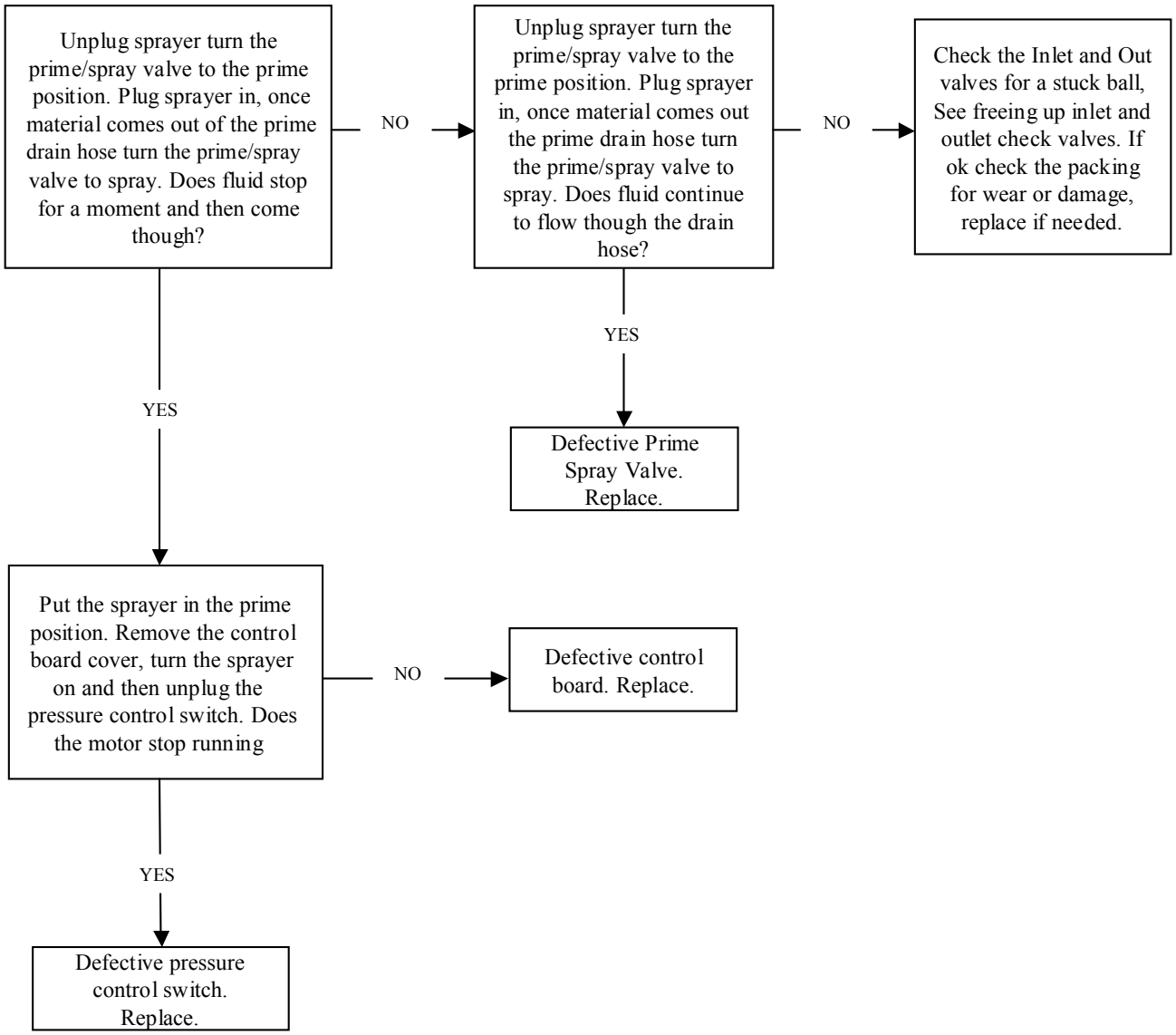
Step 4

Checking the motor wires for a short.
Put the (+) meter lead on the motor case.
Move the (-) meter lead to each wire.
Meter should read open on all the wires.



FinishPro 390
Control Board 261779

Motor will not shut off:



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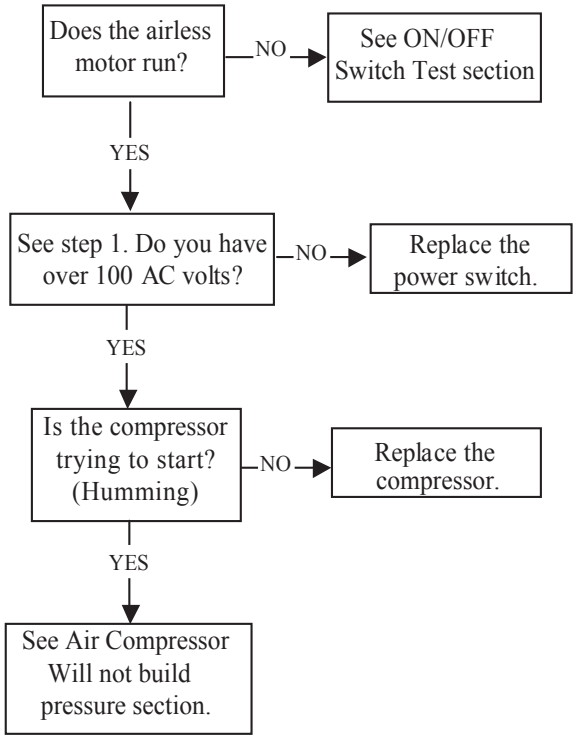
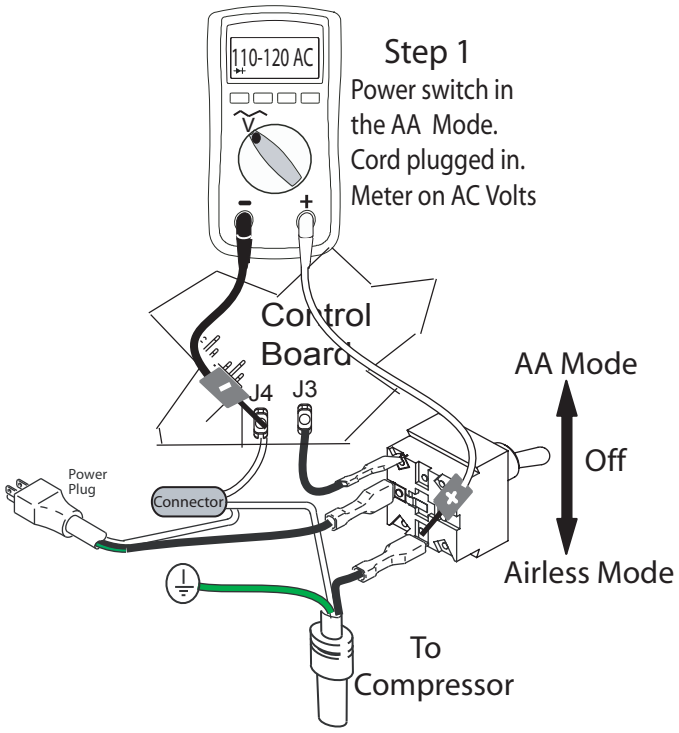
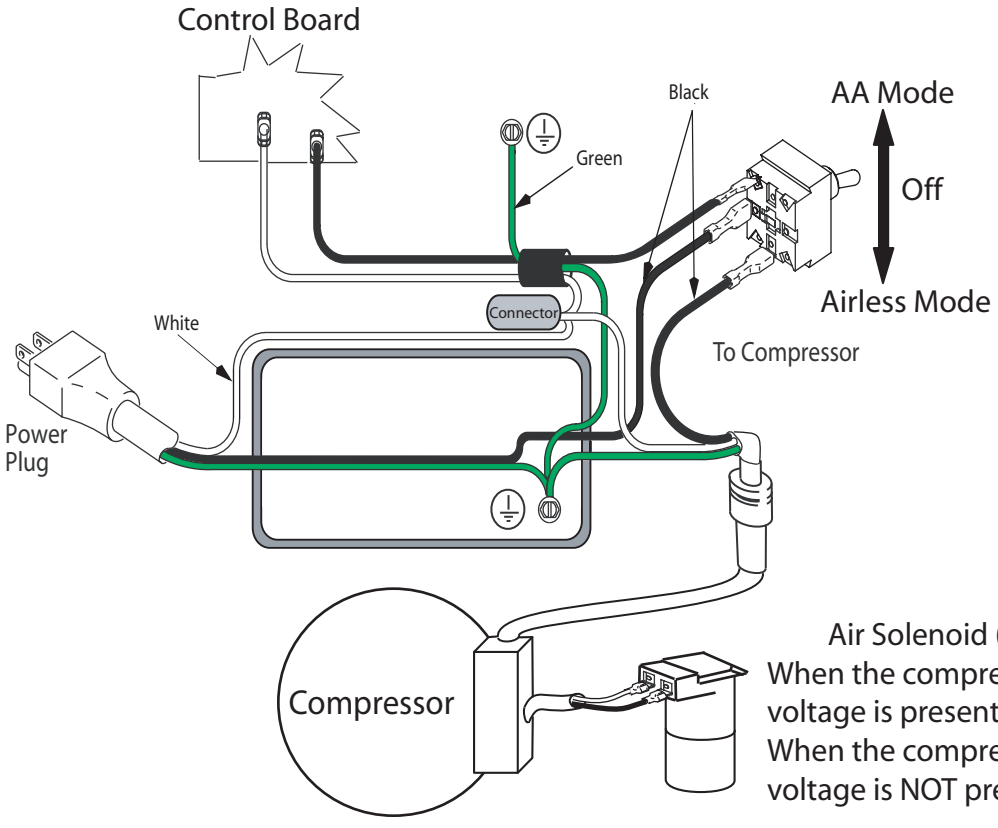
Air Compressor will not start.

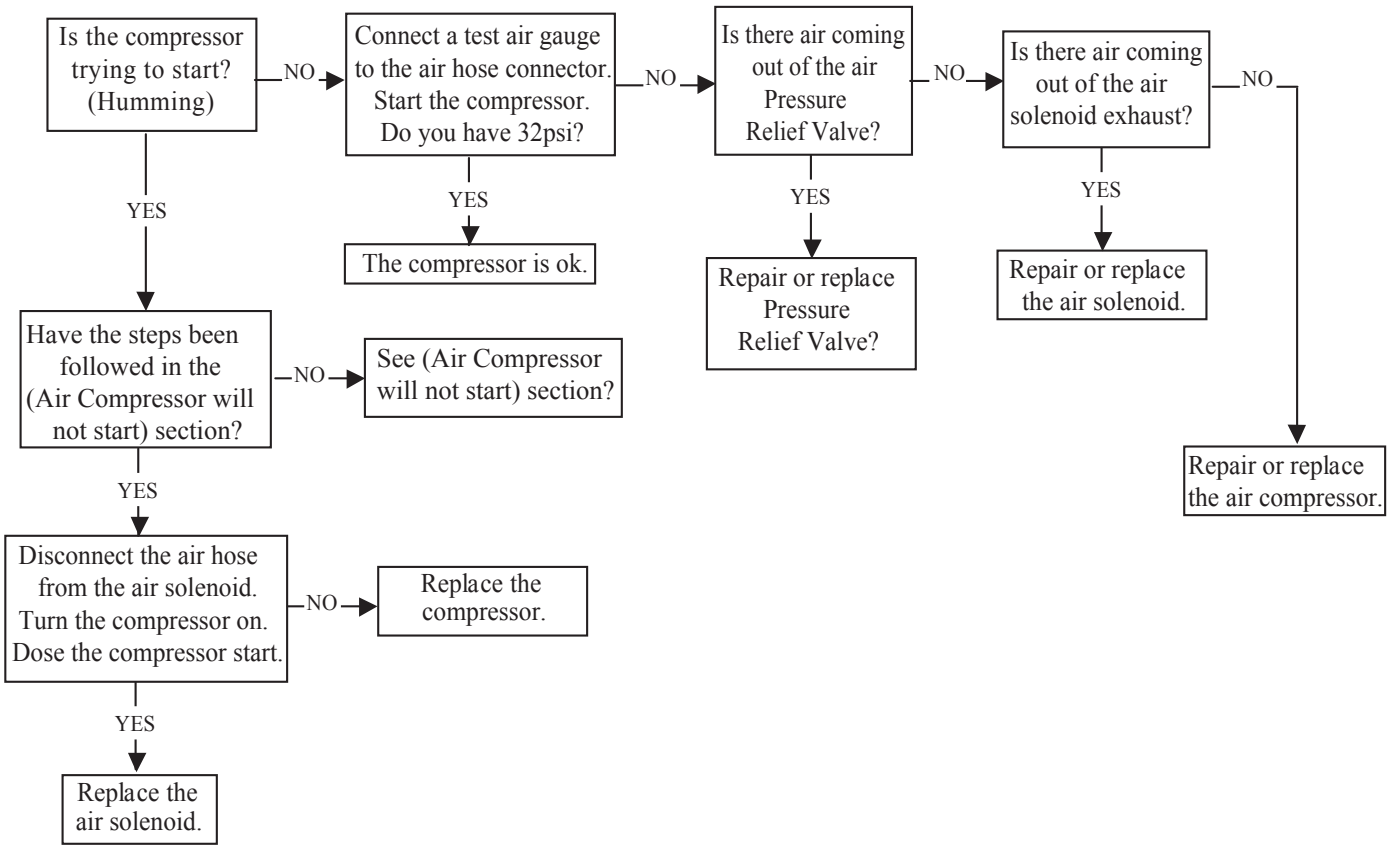


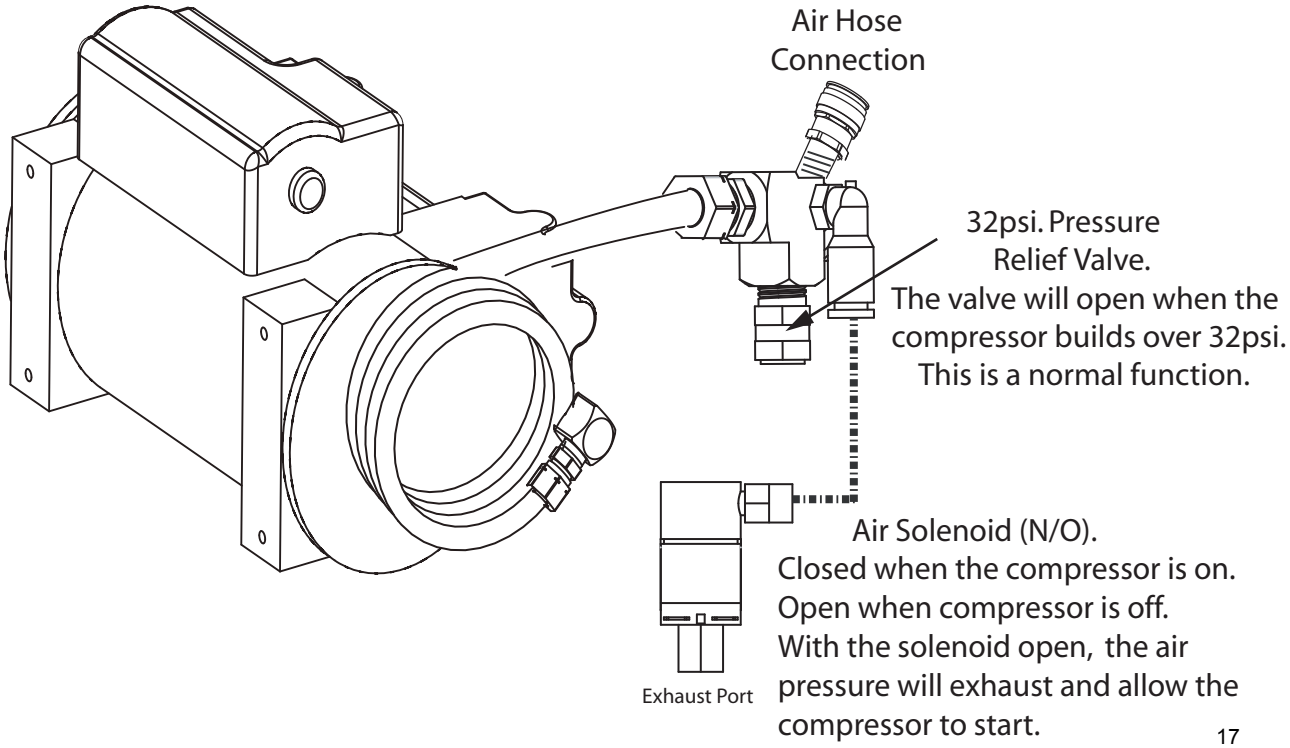




Air Solenoid (N/O).
When the compressor is ON, voltage is present.
When the compressor is OFF, voltage is NOT present.

390 FinishPro
Air Compressor runs but will not build pressure.

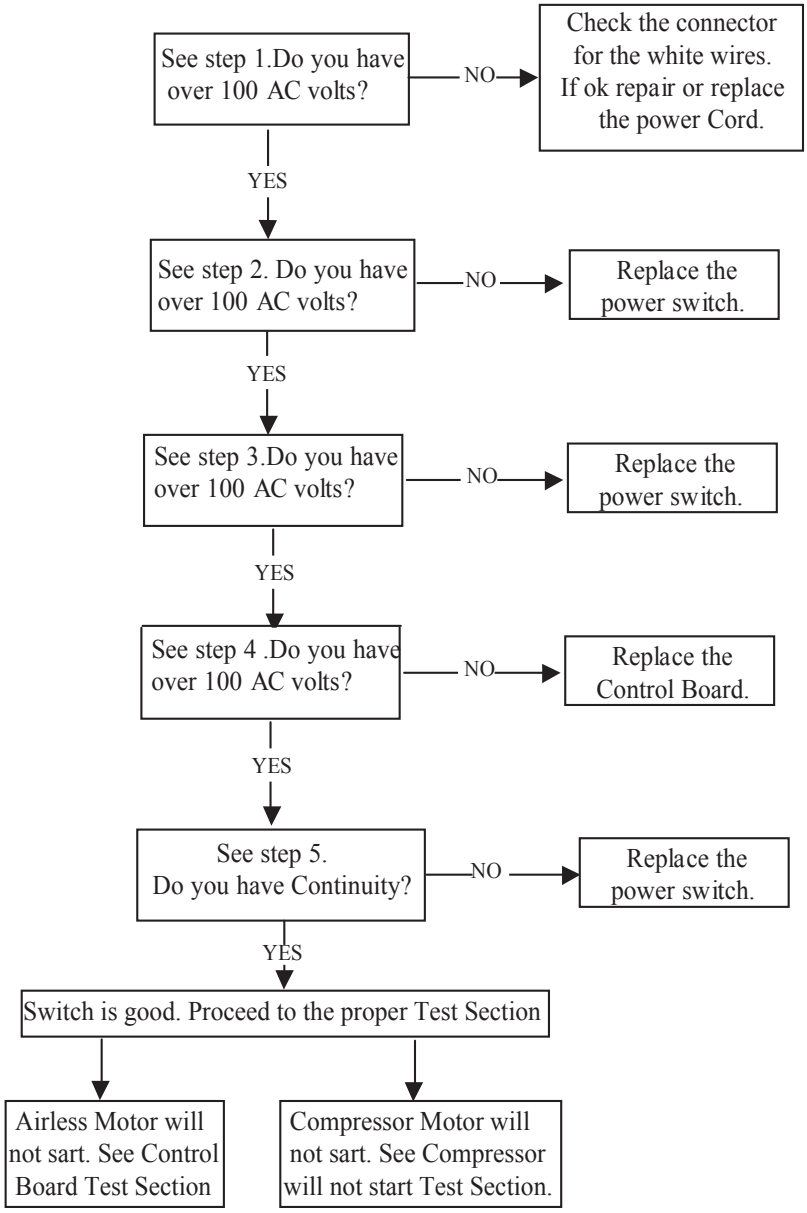




FinishPro 395

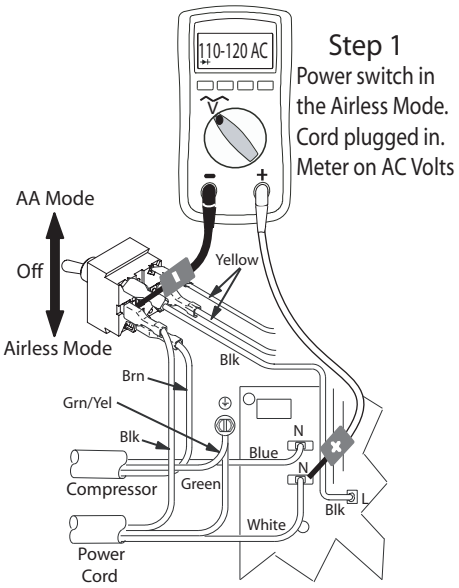
ON/OFF Switch Test

See pages 18 for the steps and illustrations.



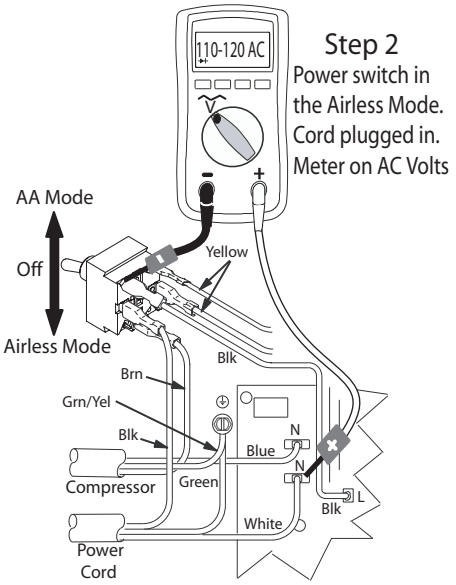
FinishPro 395

ON/OFF Switch Test



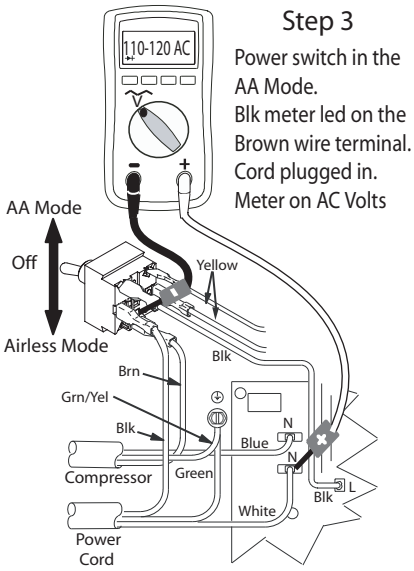
Step 1

Power switch in the Airless Mode.
Cord plugged in.
Meter on AC Volts



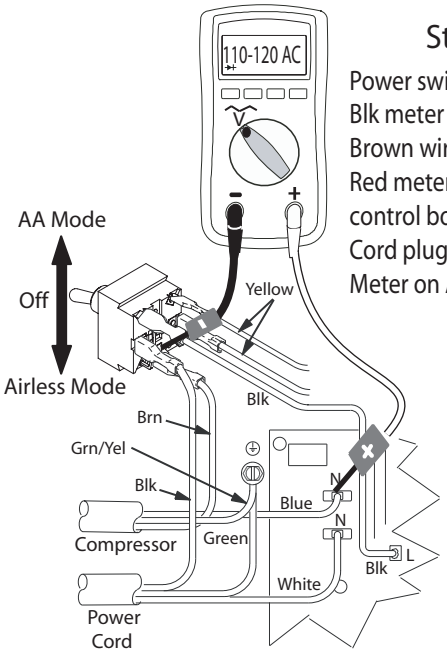
Step 2

Power switch in the Airless Mode.
Cord plugged in.
Meter on AC Volts



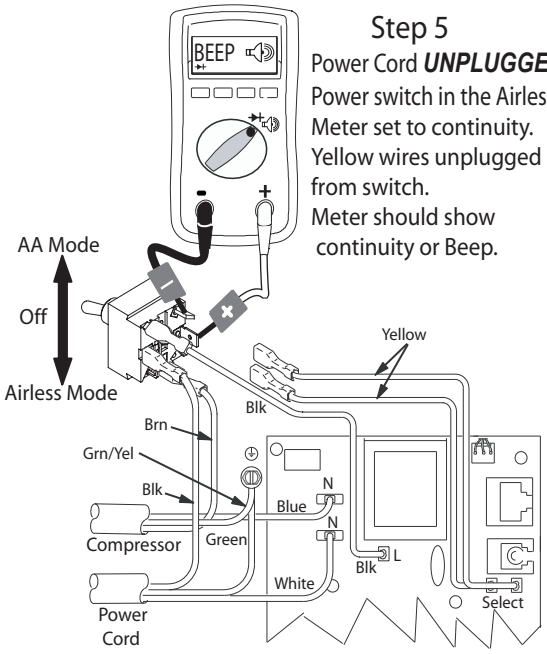
Step 3

Power switch in the AA Mode.
Blk meter led on the Brown wire terminal.
Cord plugged in.
Meter on AC Volts



Step 4

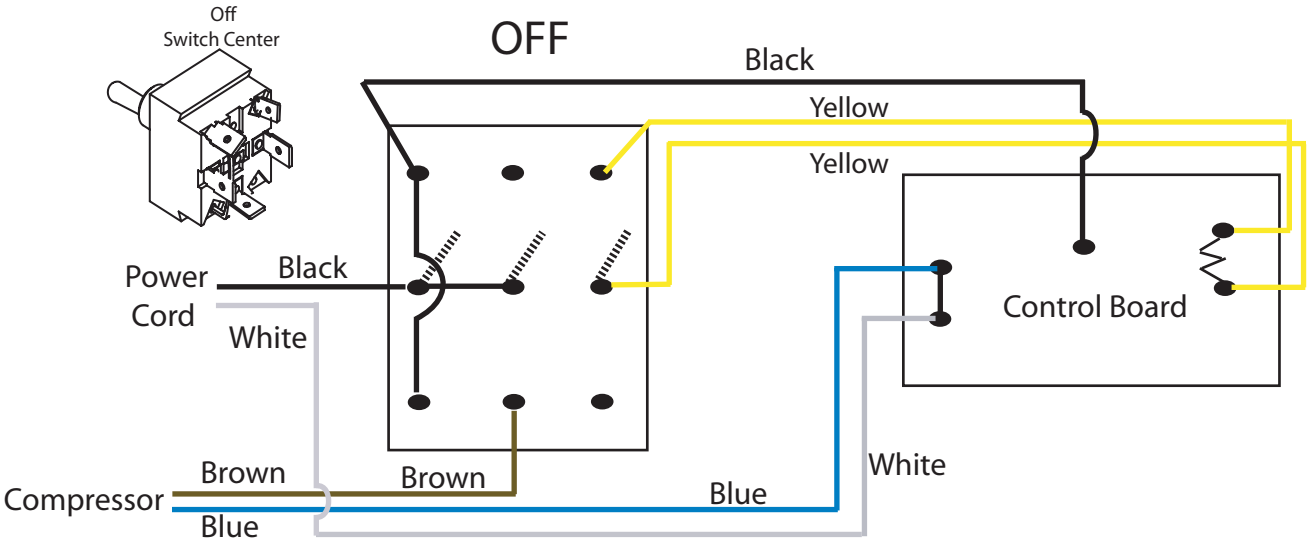
Power switch in the AA Mode.
Blk meter led on the Brown wire terminal.
Red meter led on Blue wire on control boards N.
Cord plugged in.
Meter on AC Volts

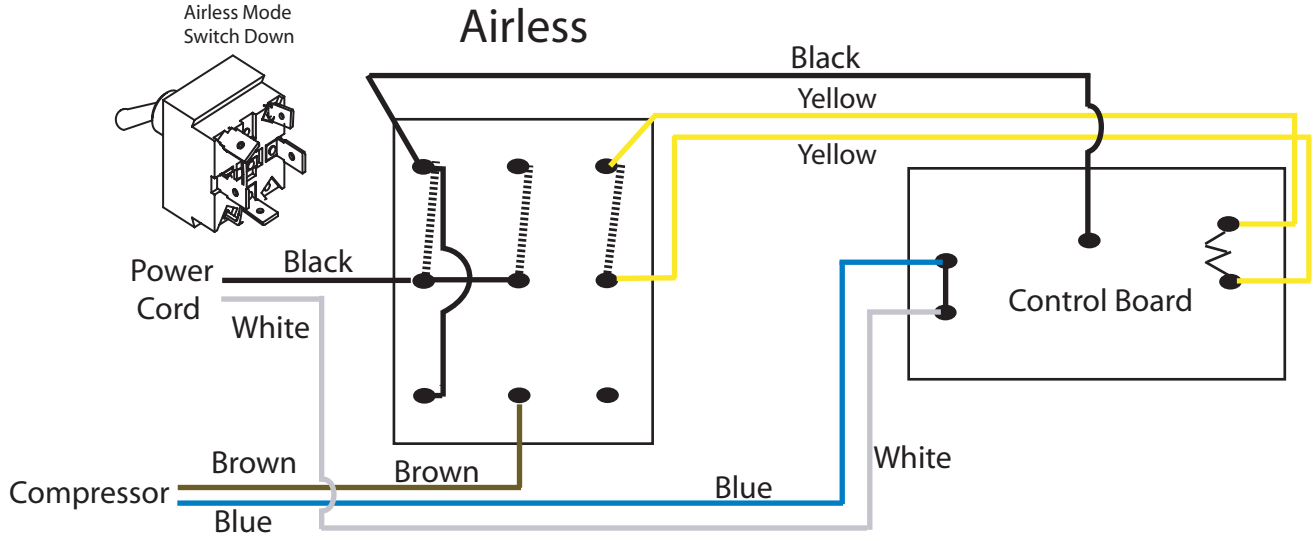


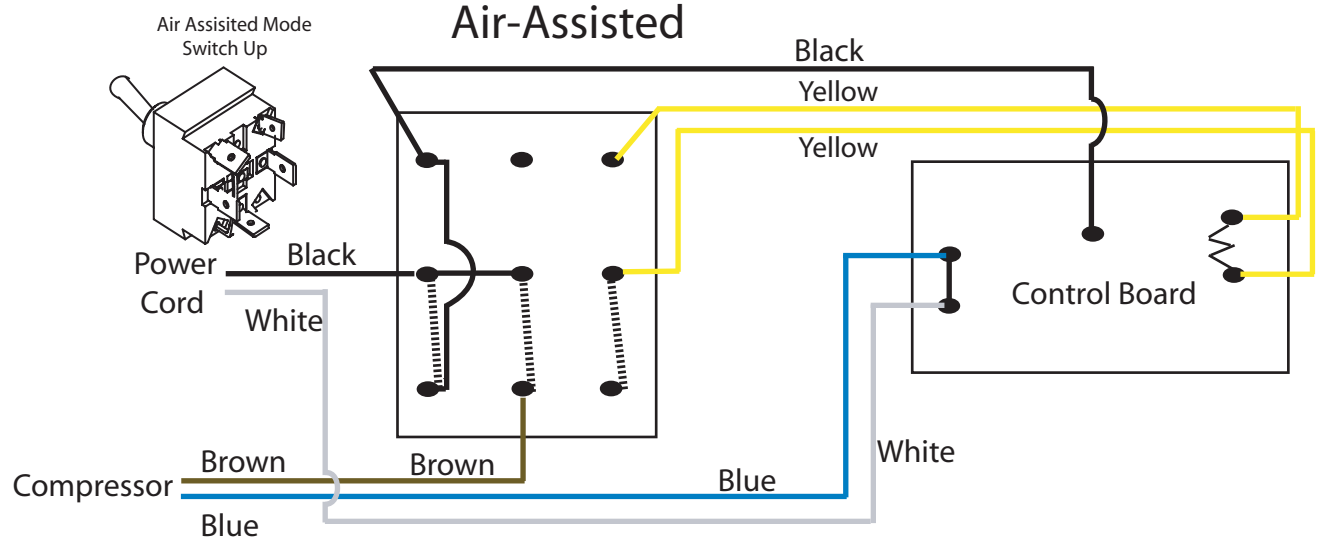
Step 5

Power Cord ***UNPLUGGED***.
Power switch in the Airless Mode.
Meter set to continuity.
Yellow wires unplugged from switch.
Meter should show continuity or Beep.

FinishPro™ 395 Switch Ladder Diagram





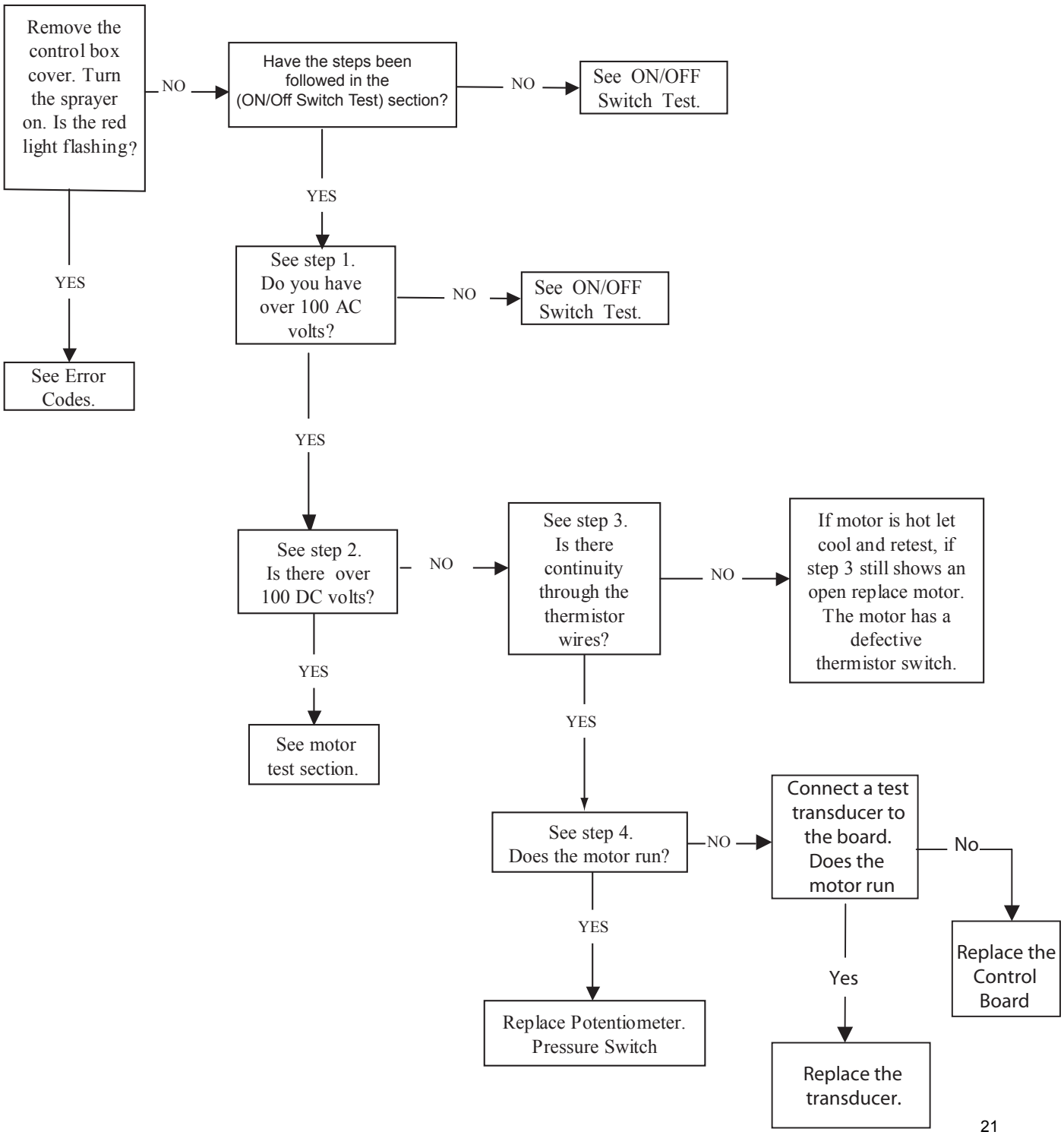


FinishPro 395

288840 Control Board

Airless Motor will not run

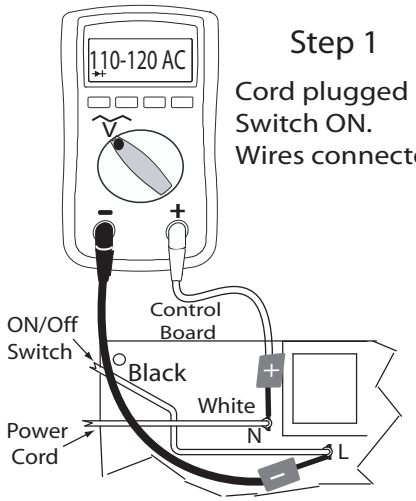
See page 20 for the steps and illustrations.



FinishPro 395

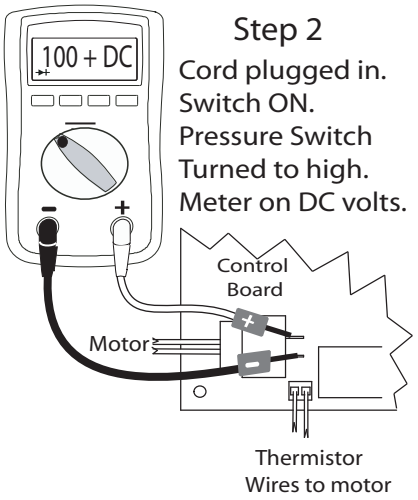
288840 Control Board

Airless Motor will not run



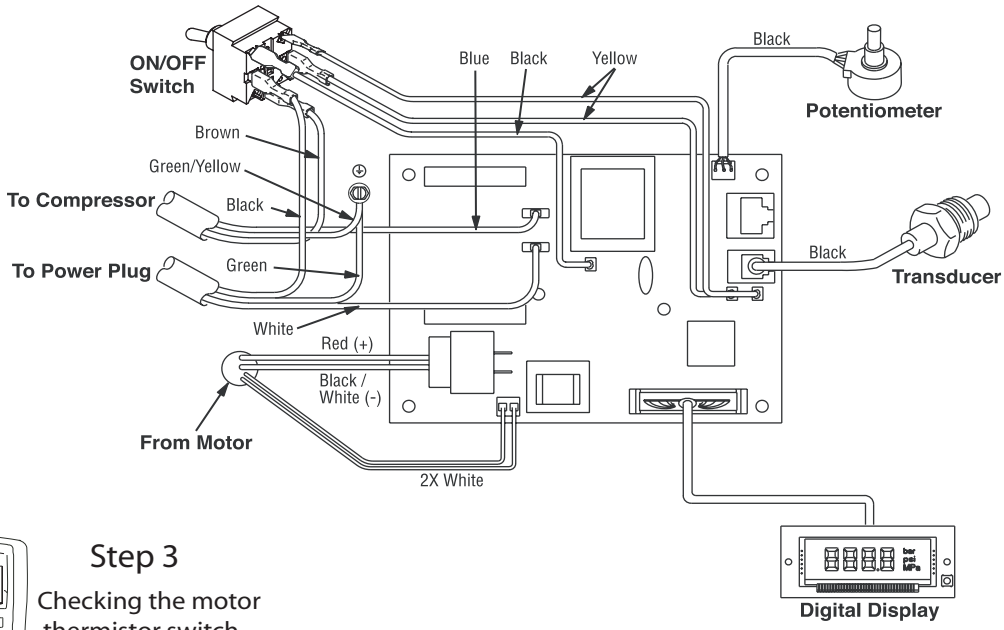
Step 1

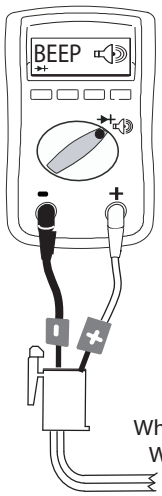
Cord plugged in.
Switch ON.
Wires connected.



Step 2

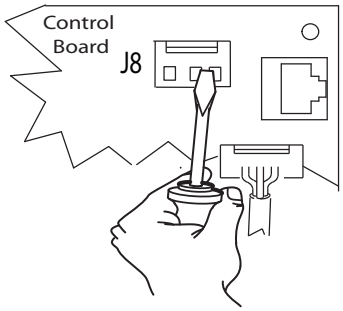
Cord plugged in.
Switch ON.
Pressure Switch
Turned to high.
Meter on DC volts.





Step 3

Checking the motor thermistor switch .
Unplug the J11 2 white wires from control board.
Meter should read continuity. Note: motor should be cooled down.



Step 4

Cord plugged in.
Switch ON.
Potentionmeter disconnected.

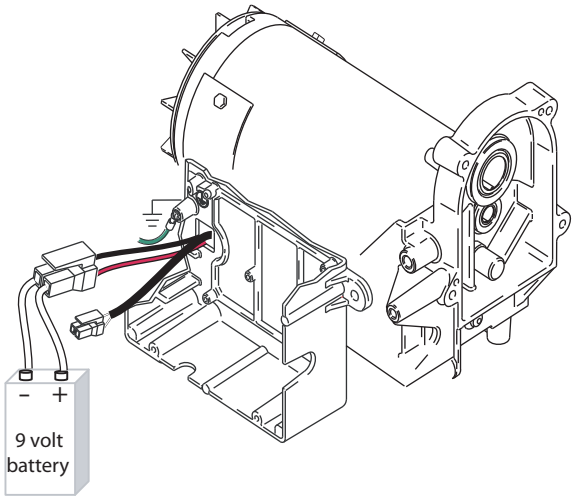
288859 Motor Test

1. Remove the pump pin and try to run the sprayer.If the motor runs check for locked or frozen pump or drive train. If sprayer does not run, go to next step.
2. Set sprayer to OFF and disconnect power to sprayer .
3. Disconnect motor connector from control board . Check the motor connector and control board contacts. They must be clean and secure. Reconnect motor connector to control board socket(s). Turn the pressure knob clockwise a ½ turn. Try to restart the motor. If motor does not run follow the steps below.

Use CAUTION not to distort the connectors when inserting the meter probes.

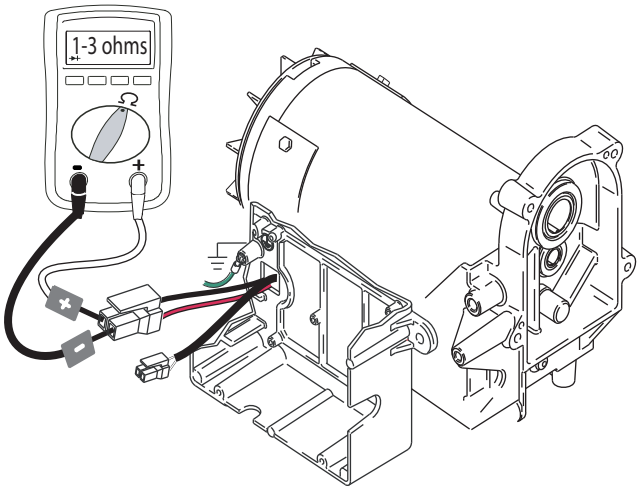
Step 1

Perform a spin test by connecting a 9 volt battery or larger to the motor leads.



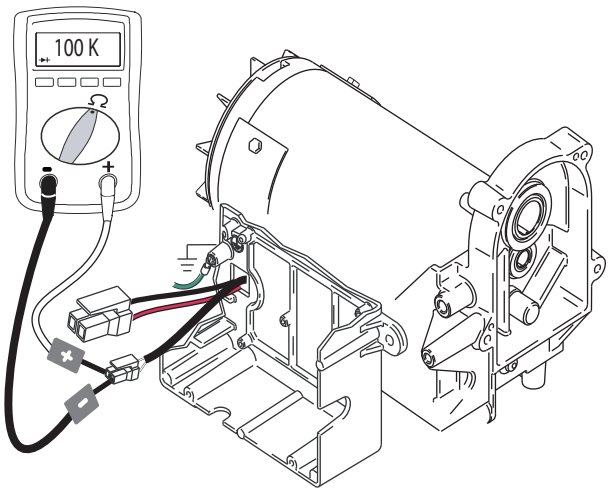
Step 2

Spin the motor while checking.
If a open is found replace the motor.



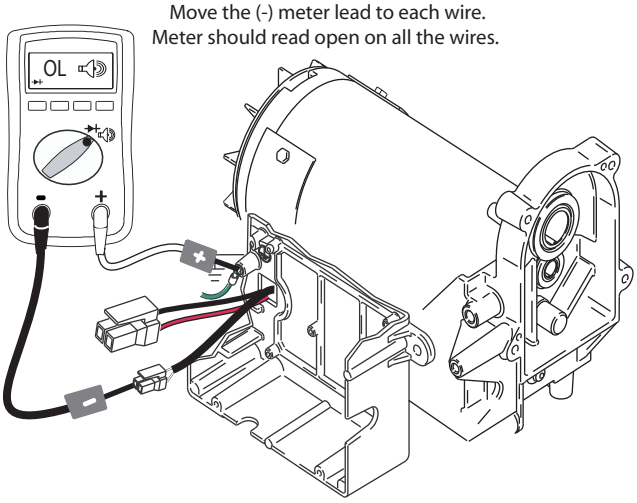
Step 3

Checking the motors thermal protection.
Meter should read100K ± 5%.
Note: motor should be cooled down.



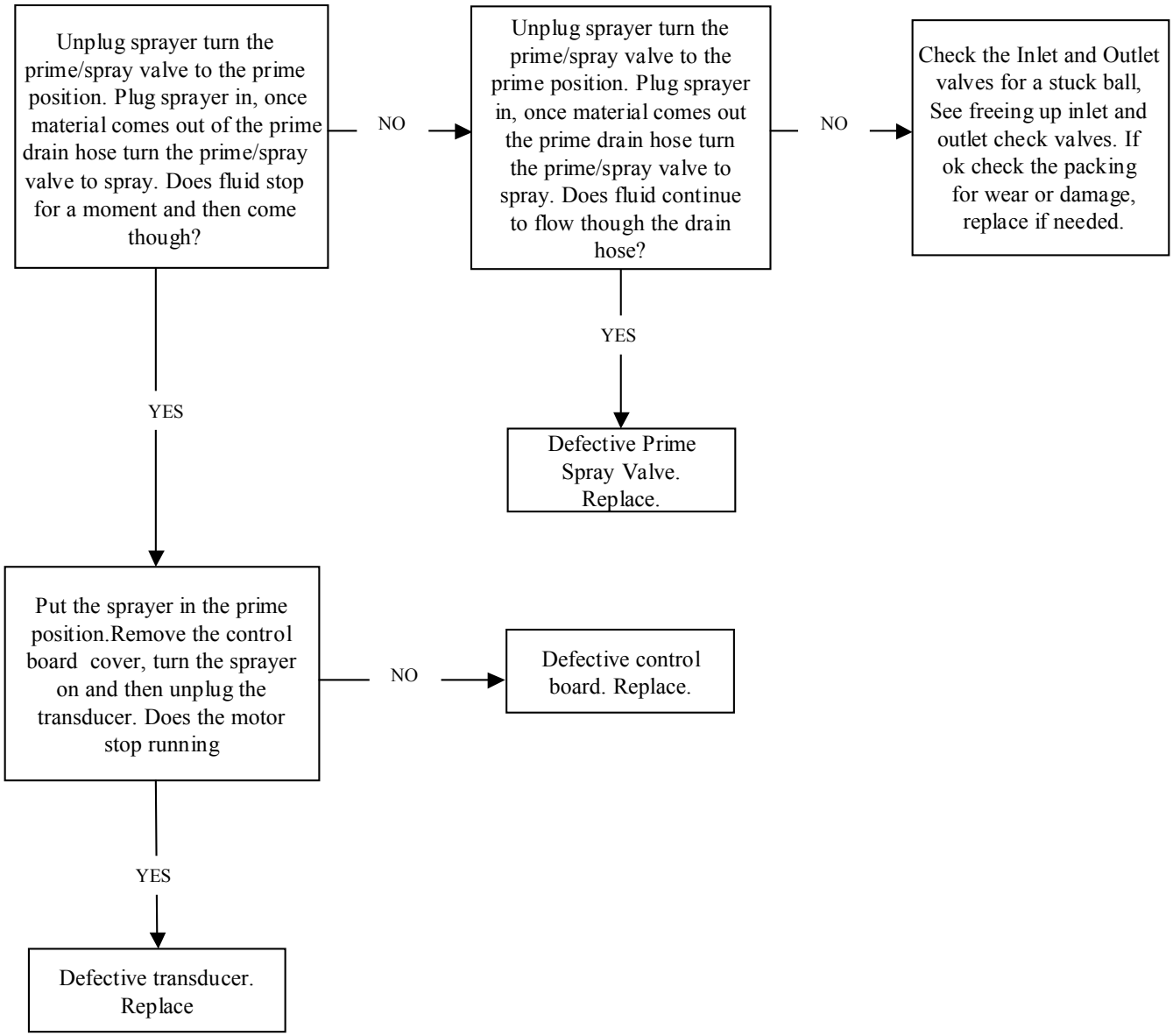
Step 4

Checking the motor wires for a short.
Put the (+) meter lead on the motor case.
Move the (-) meter lead to each wire.
Meter should read open on all the wires.



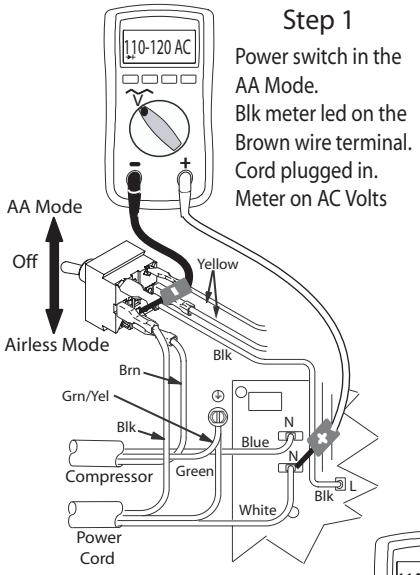
FinishPro 395
Control Board 288840

Motor will not shut off:

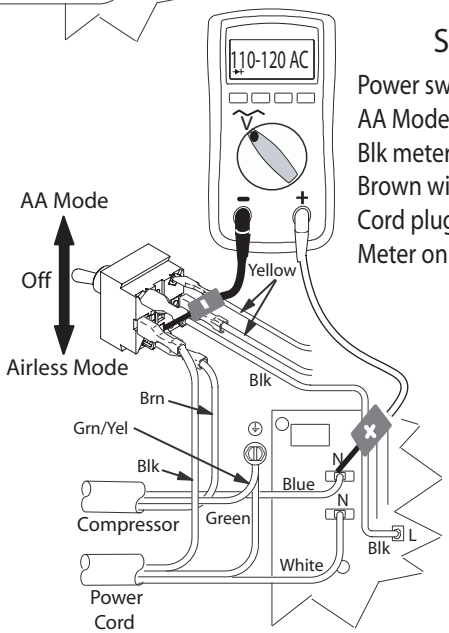


395 FinishPro
Air Compressor will not start.

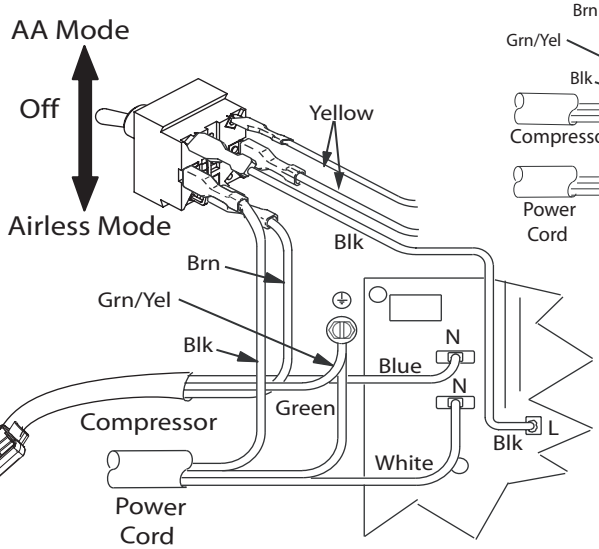
Does the airless motor run?
NO → See ON/OFF Switch Test section
YES ↓
See step 1. Do you have over 100 AC volts?
NO → Replace the power switch.
YES ↓
See step 2. Do you have over 100 AC volts?
NO → Replace the Control Board.
YES ↓
Is the compressor trying to start? (Humming)
NO → Replace the compressor.
YES ↓
See Air Compressor Will not build pressure section.

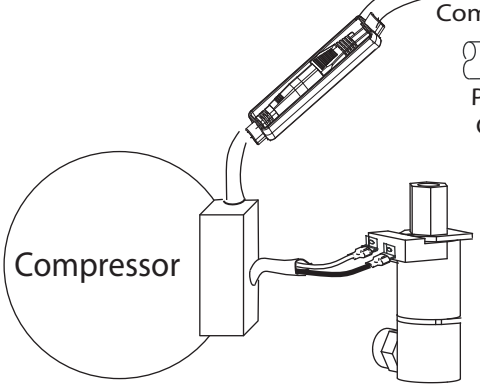


Step 1
Power switch in the AA Mode.
Blk meter led on the Brown wire terminal.
Cord plugged in.
Meter on AC Volts



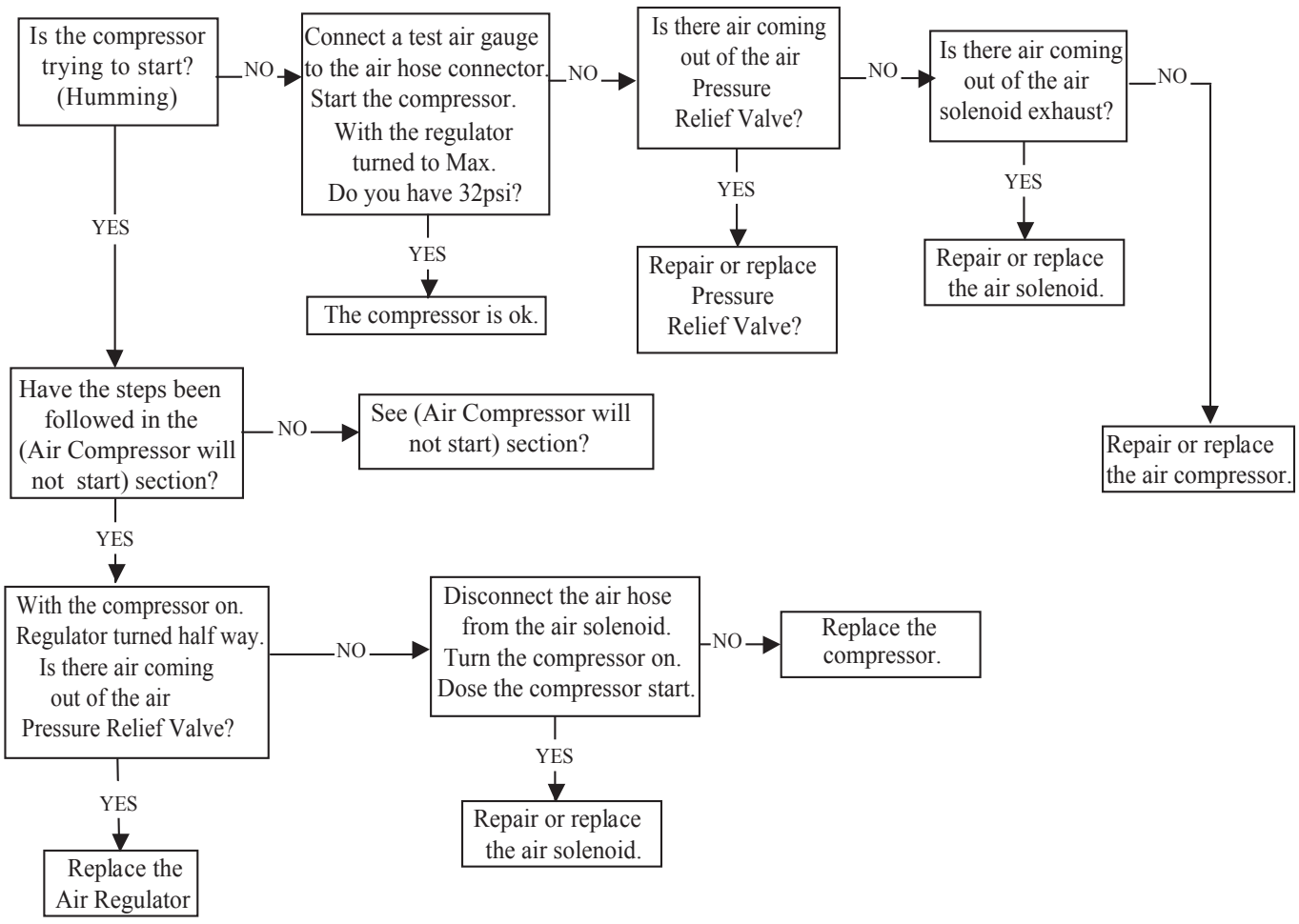
Step 2
Power switch in the AA Mode.
Blk meter led on the Brown wire terminal.
Cord plugged in.
Meter on AC Volts

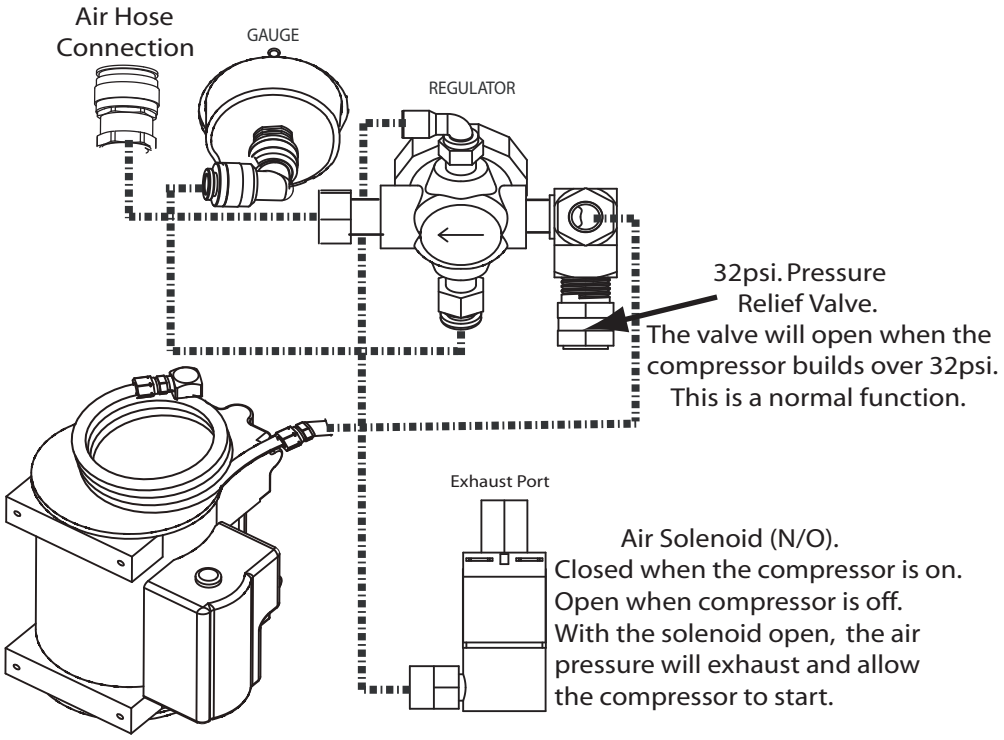




Air Solenoid (N/O).
When the compressor is ON, voltage is present.
When the compressor is OFF, voltage is NOT present.

395 FinishPro
Air Compressor runs but will not build pressure.



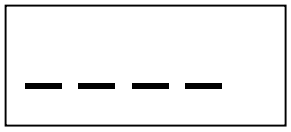


FinishPro 395 Error Codes
288840 Control Board

Error Codes:

CONTROL BOARD STATUS LIGHT.	INDICATION	GO TO PAGE
One Blink when switch is turned on.	Power to board is ok, No RUN command to motor.	21
Constant on	Control is commanding motor to run .	28
Blinks 2 x repeatedly	High pressure signal from transducer.	29
Blinks 3 x repeatedly	Transducerfailure or connection error.	30
Blinks 4 x repeatedly	Excessive Wall voltage	31
Blinks 5 x repeatedly	High current or motor is not turning.	32
Blinks 6 x repeatedly	Motor is too hot or motor/thermal device connection may be bad.	33

Symptoms:



- Sprayer does not run at all
- Digital Display shows dashes and Psi icon is not blinking
- Control board status light blinks once when switch is turned on but then stays off.

What does this mean?

Power to board is ok but there is no RUN command to the motor. Either the potentiometer or control board is likely the problem.

Troubleshooting Procedure:

Check potentiometer & connections to control board. Set sprayer to OFF.

Disconnect potentiometer from control board socket. Check that potentiometer and control board contacts are clean and secure.

Reconnect potentiometer to control board socket. Set sprayer ON and control knob to ½ turn clockwise. If sprayer does not run, set sprayer to OFF and go to next step.

Connect a known good potentiometer to control board socket and set sprayer ON and control knob to ½ turn clockwise. If ok, replace pot. Replace control board if sprayer still does not run. But first, verify transducer and connections are ok. See next page.

OR

Short center pin of socket to each outer pin. Install new potentiometer if sprayer runs. Replace control board if sprayer does not run. But first, verify transducer and connections are ok. See next page.

Check transducer & connections to control board. Set sprayer to OFF and **disconnect power to sprayer**.

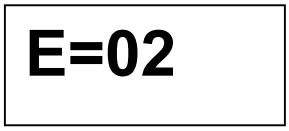
Disconnect transducer from control board socket. Check that transducer and control board contacts are clean and secure.

Reconnect transducer to control board socket. Connect power, set sprayer ON and control knob to ½ turn clockwise. If sprayer does not run, set sprayer to OFF and go to next step.

Connect a known good transducer to control board socket.
Set sprayer ON and control knob to ½ turn clockwise. Install new transducer if sprayer runs. Replace control board if sprayer does not run.

Symptoms:

- Sprayer does not run at all
- Digital Display shows E=02



- Control board status light blinks 2x repeatedly.

What does this mean?

The control board is detecting an excessive pressure. The transducer or connections is likely the problem.

Troubleshooting Procedure:

1. Make sure there is no pressure in the system (see pressure relief procedure). Check fluid path for clogs, such as clogged filter.

2. If running Auto Clean, open prime valve and trigger gun.

3. Use airless paint spray hose with no metal braid. ¼ in. x 50 ft minimum. Smaller hose or metal braid hose may result in high-pressure spikes.

4. Set sprayer to OFF and **disconnect power to sprayer**.

5. **Check transducer & connections** to control board.

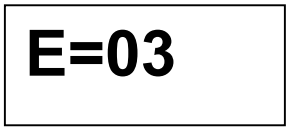
1. Disconnect transducer from control board socket. Check that transducer and control board contacts are clean and secure.

2. Reconnect transducer to control board socket. Connect power, set sprayer ON and control knob to ½ turn clockwise. If sprayer does not run properly, set sprayer to OFF and go to next step.

3. Replace transducer. Connect power, set sprayer ON and control knob to ½ turn clockwise. Install new transducer if sprayer runs properly. Replace control board if sprayer does not run properly.

Symptoms:

- Sprayer does not run at all
- Digital Display shows E=03



- Control board status light blinks 3x repeatedly.

What does this mean?

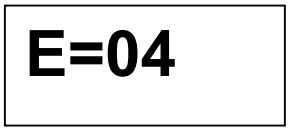
The control board is not detecting a pressure signal.
The pressure transducer or connections are likely the problem.

Troubleshooting Procedure:

1. Set sprayer to OFF and disconnect power to sprayer.
2. Check transducer & connections to control board.
3. Disconnect transducer from control board socket. Check that transducer and control board contacts are clean and secure.
4. Reconnect transducer to control board socket. Connect power, set sprayer ON and control knob to ½ turn clockwise. If sprayer does not run, set sprayer to OFF and go to next step.
5. Connect a known good transducer to control board socket.
6. Set sprayer ON and control knob to ½ turn clockwise. Install new
7. transducer if sprayer runs. Replace control board if sprayer does not run.
8. You can also check transducer resistance with an ohmmeter; Between red & black wires – less then 9 k ohm and 3-6 k ohm between green & yellow wires.

Symptoms:

- Sprayer does not run at all
- Digital Display shows E=04



- Control board status light blinks 4x repeatedly.

What does this mean?

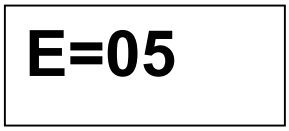
Voltage applied to the sprayer is too high.

Troubleshooting Procedure:

1. Make sure the sprayer is plugged into the proper AC power source. Less than 138 volts for 120V sprayers and less than 260V for 230V sprayers.

Symptoms:

- Sprayer does not run at all
- Digital Display shows E=05



- Control board status light blinks 5x repeatedly.

What does this mean?

The control is commanding the motor to run but the motor shaft does not rotate. Possibly locked rotor condition, an open connection exists between the motor and control, there is a problem with the motor or control board or the motor amp draw is excessive.

Troubleshooting Procedure for Brush Type Motors

1. Remove the pump pin and try to run the sprayer. If the motor runs check for locked or frozen pump or drive train. If sprayer does not run, go to next step.

2. Set sprayer to OFF and **disconnect power to sprayer**.

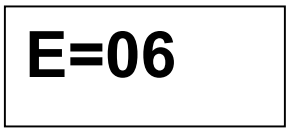
3. Disconnect motor connector(s) from control board socket(s). Check that motor connector and control board contacts are clean and secure. If ok go to Step 4.

4. **Check motor. See Motor Testing .** Or connect a D.C. voltmeter across two motor wires – red & black spin the motor fan and check for a voltage to register on the meter. If voltage **not** present, check brushes. If ok, replace motor. If voltage present, go to next step.

5. Reconnect motor connector(s) to control board socket(s). Connect power, set sprayer ON and control knob to ½ turn clockwise. If motor does not run, replace control board

Symptoms:

- Sprayer does not run at all
- Digital Display shows E=06



- Control board status light blinks 6x repeatedly.

What does this mean?

Motor is too hot or motor thermal switch connections are likely the problem.

Troubleshooting Procedure:

1. Check thermal switch and connections to control board. Set sprayer to OFF and **disconnect power to sprayer**.
2. Disconnect motor thermal switch wires from control board. Check that all connections at the control board are clean and secure.
3. If connections are all OK, allow sprayer to cool. If sprayer runs when cool, correct cause of overheating. Keep sprayer in cooler location with good ventilation. Make sure motor air intake is not blocked. If sprayer still doesn't run go to step 4.
4. See Airless Motor Test procdure for the appropriate motor.