# Service Instructions

**Models:** **5B** **28B/H** **136B/H**
**14B/H** **57B/H** **208B/H**
**19B/H** **104B/H**

DENTSPLY Ceramco
Yucaipa, CA

## SAFETY FIRST

* Don’t bypass the power cord’s ground lead with two-wire extension cords or plug adaptors.

* Don’t disconnect green/yellow safety-earth ground wire that connects the ground lug of the power receptacle to the chassis ground.

* Don’t plug in the power cord until directed by the installation instructions.

* Don’t repair the cleaner unless you are a qualified electronics technician and know how to work with hazardous voltages.

* Don’t operate the cleaner with hazardous chemicals or materials in or around it.

* Pay attention to the WARNING statements in the operator's manual and this document. They point out situations that can cause injury or equipment damage.

# TABLE OF CONTENTS

# SECTION 1
# CIRCUIT DESCRIPTION

## 1.1 INTRODUCTION

The purpose of this section is to familiarize the user or service personnel with the circuit level operation of the Ultrasonik Cleaners. This knowledge will aid in the troubleshooting of a failed cleaner. Safety must be practiced at all times because of the high voltages inside the cleaner.

The block diagram of the ultrasonic cleaner is shown below. The operational description that follows is separated into three functional blocks:

* Power Control & Conditioning consisting of the mechanical timer, voltage spike suppression, rectification, and electrical noise filtering.

* Oscillator / Amplifier consisting of the electronic power switches (Power FET's), feedback circuitry, and biasing circuits/feedback transformer.

* Resonant Components consisting of the output inductor and piezo disk / tank assembly. The piezo disk has the electrical affect of a lossy capacitor.

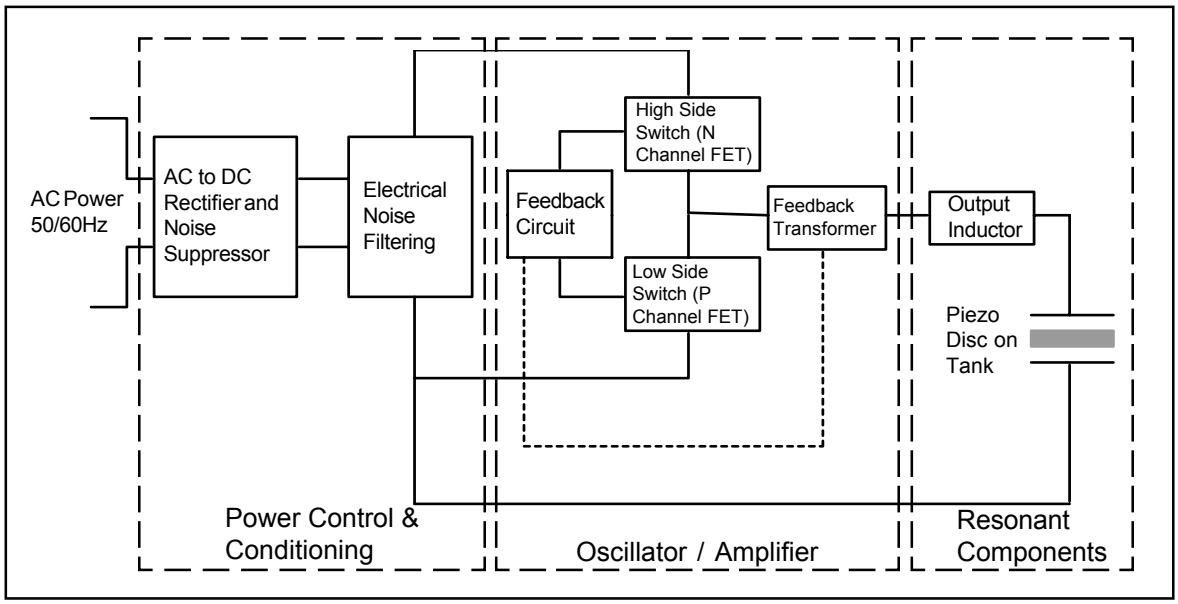



Fig. 1: Circuit Block Diagram

## 1.2 DETAILED CIRCUIT DESCRIPTION

1.2.1 Power Conditioning

1.2.1.1 Mechanical Timer

The mechanical timer breaks the high line or hot side of the AC power coming into the cleaner for the ultrasonic generator. It does not disconnect power to the heater. The heater is treated as a separate circuit and is only controlled by the lighted switch on the front panel.

1.2.1.2 Input Protection

The high side of the AC power is fused and clamped to the AC neutral with a varistor that clamps voltage spikes at approximately 120 - 150% of nominal line peak voltage.

1.2.1.3 Rectification

The AC power is half wave rectified for the models 14 and 19 and full wave rectified for all the other models.

1.2.1.4 Electrical Noise Filtering

The next three components form a Pie filter. These are the two capacitors across the AC line and a series inductor. These components act as a low pass filter and energy storage. They filter or block the fundamental ultrasonic frequency and its harmonics from being transmitted onto the AC power lines.

1.2.2 Oscillator / Amplifier

1.2.2.1 Power Switching

The power switching of the oscillator / amplifier is done by two power FET's. A half bridge circuit is formed with a N-channel FET tied to the +V high voltage supply and a P- channel FET tied to the common or return line.

1.2.2.2 Feedback Current Transformer
The required feedback for the amplifier to oscillate is derived from the feedback toroid transformer that senses the main current in the oscillator. A small fraction of this main oscillator current is fed back.

1.2.2.3 Feedback Circuit
The current flowing through the output inductor is also fed through a feedback transformer. This transformer converts the current into a voltage which is capacitively coupled to the gates of the FET's. The cap provides a DC current block to the start-up circuitry. The FET's gates have limiting resistors that prevent localized oscillations. Back to back Zener diodes limit the gate voltage by clamping the gate voltage to the FET and protecting it. The N-channel FET is biased from the +V high voltage with a 100K resistor. This resistor and two others provide the start-up voltage and they also act to stabilize the circuit.

1.2.3 Resonant Components
1.2.3.1 The basic L-C oscillator is formed by a high frequency magnetic core inductor (L3 on the PC board) and the capacitance of the piezo disk(s) bonded to the bottom of the tank. The capacitance of the piezo disks vary due to a number of factors. Because of this, a compensation capacitor is added in parallel with the piezos bonded to the tank. This will provide the optimum performance.

1.2.4 Heater System Components
Not pictured on the block diagram.

1.2.4.1 Heater Switch
The heater switch (DPST) turns on the line voltage to the heaters (resistive) attached to the tank. The light in the switch is on when the switch is on. It is not directly associated with the heaters supplying power.

1.2.4.2 Thermal Limiter Switch (28H and larger only)
The thermal limiter controls line voltage to the silicone pad heaters to regulate water temperature. The thermal limiter opens at approximately 60°C and closes again at 45°C. The ultrasonic energy put into the tank during normal operation is generally sufficient to trip the thermal limiter when operated for a long period of time.

1.2.4.3 Heater
The heater(s) are mounted on the rear wall of the tank as close as possible to the bottom. (On model 104H 220/240V, heaters are mounted to the sides; Model 208H, heaters are mounted to the rear wall and sides.) The heater wattage varies depending on tank size and model voltage. Low voltage cleaners use a single heater. Model 28 and larger cleaners have two 120V heaters on the 220 and 240V models. These heaters are connected in series which doubles the wattage and reduces the heating time.

1.2.4.4 Heater 230V Models
On 230V models, all cleaners utilize 240V heater (two 240V heaters connected in parallel). The heaters on all 230V cleaners are thermal protected by a thermal switch which is RTV mounted to the heater.

# SECTION 2
# TROUBLESHOOTING

## 2.1 FACTORY REPAIR

DENTSPLY Ceramco maintains a factory repair department for those customers not possessing the necessary personnel or test equipment to repair Ultrasonic Cleaners. If a unit is to be returned to the factory for repair, an authorization number needs to be obtained and a detailed description of the specific problem should be attached to minimize repair turnaround time.

## 2.2 BEFORE YOU START

Since no troubleshooting guide can possibly cover all the potential problems, the aim of this guide is to give a methodology which, if applied consistently, will lead to the problem area. Therefore it is necessary to familiarize yourself with ultrasonic cleaners by reviewing the previous functional description and circuit description in conjunction with the control board schematic. Please read the operator's manual which contains basic operational suggestions and a number of important safety precautions.

**WARNING:**
**WITH THE BASEPLATE REMOVED, DANGEROUS HIGH VOLTAGE POINTS WILL BE EXPOSED. CONTACT WITH ANY OF THESE POINTS COULD CAUSE SERIOUS INJURY.**

The following information is intended to define the general and operational requirements to check the cleaner for proper operation.

The basic design of the cleaner circuit is that of an oscillator. In order for the oscillator to oscillate all functions must be operational.

Always do a visual inspection of all the components before attempting to power up the cleaners. Look for damaged, burnt or bad components which may be the cause or only a symptom of the problems. Wiring connections should be inspected for signs of discoloration and overheating. Inspect the piezo disc for signs of damage.

Look for water stains on the bottom of the tank and on both sides of the PC board. A temporary water short caused by water on the PC board may only cause a temporary problem or may cause permanent damage.

The following are various symptoms to look for when troubleshooting the PC board.

> Inspect the FET tabs for signs of discoloration. If discolored they have been operated in an overpowered condition.

> Inspect the PC board area around the FET's for signs of discoloration (brown color). This is also a sign of overpower operation.

>If the high voltage (140-180VDC) exists across capacitor C2 then the FET's need to be checked next, followed by the Zener diodes. If the voltage is not present check fuse F1 or the diode bridge.

## 2.3 TROUBLESHOOTING GUIDES

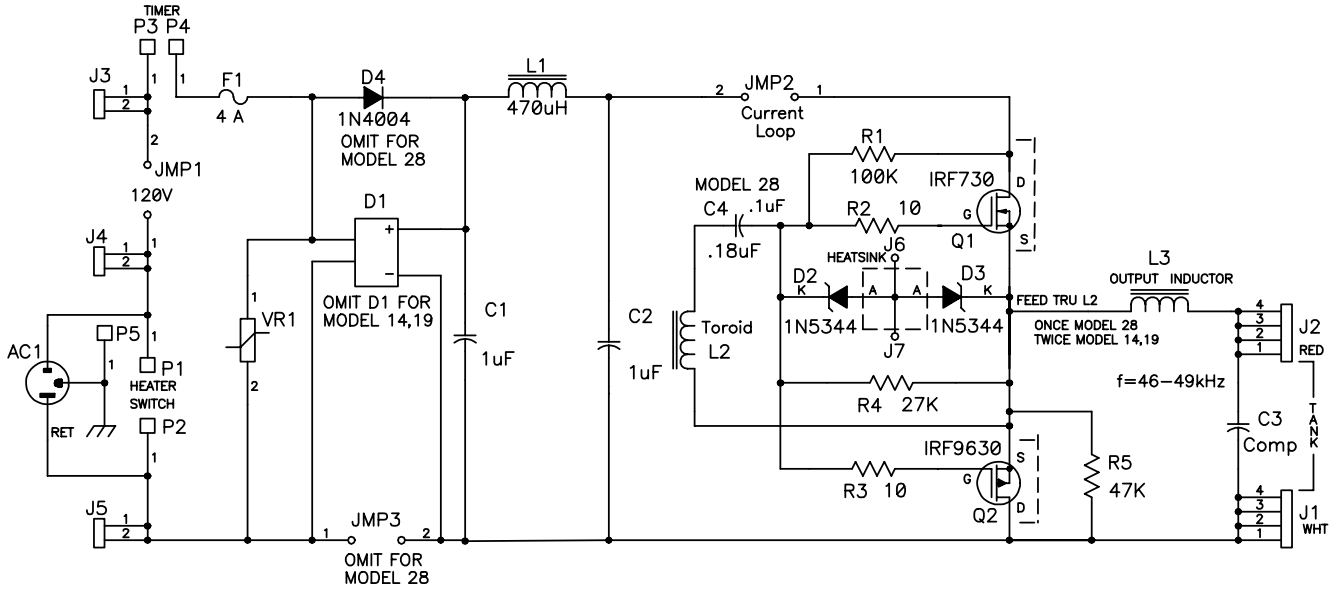



Fig. 2: Circuit Schematic (For Models 57, 104 and 208 use the Model 28 jumper settings.)

The following description will discuss the general circuit schematic Fig. 2. The larger cleaners (Models 104 and 208) will use two of these generators to power two PZT's and will have similar operation. (3 PCB's on Model 208.)

2.3.1 FET's

The power FET's Q1 (N-channel) and Q2 (P-channel) are the basic gain components of the oscillator and the most likely to be damaged should something go wrong. The gates of the power FET's are sensitive to over voltage and static electricity. Slight damage to a FET gate can cause high leakage and prevent the FET from turning on. See the Power FET test, Section 2-6.

2.3.2 Capacitors

Capacitors are used for three different purposes. C1 and C2 are the heart of the electrical noise filtering circuit. They work in conjunction with the inductor L1. They are not likely to fail under normal use.

Capacitor C4 is the feedback capacitor and its value and type are very important and must not be substituted. This cap is not likely to be damaged during normal operation.

Capacitor C3 is the compensation capacitor connected in parallel with the tank. The C3 capacitor is in parallel to the piezo discs with each lead connected to the red and white wire connector (connects to J1, J2 terminal). It is used to adjust the oscillation period (frequency), and the amount of power that the cleaner produces. It's value will vary depending on the piezo capacitance of the tank and the period that the cleaner operates. This capacitor can fail as a result of high voltage or high currents. Observe the bottom side of the cap to check for signs of stress or damage. Replacement tanks are supplied with the C3 cap already applied if it's required for that particular tank.

2.3.3 Fuse/varistor

The fuse and varistor function as over current/voltage protection. If a large voltage spike is applied to the AC line the varistor will clamp it to the power line. If the spike is large and/or long enough the fuse F1 will open. If the varistor is damaged or goes bad it's natural failure mode is shorted. The fuse will also interrupt the AC power to the circuit if the power FET, diode bridge or tank fails.

2.3.4 Inductor

The output inductor L3 is the magnetic portion of the resonant circuit. It has a special construction for the high frequency/high current operation. The inductance of the L3 inductor differs between models and operating voltages. It is not likely to fail unless exposed to the liquid solutions used in the cleaner's tank.

2.3.5 PZT (piezo ceramic disk or transducer)

The PZT is the transducer or active element that converts the electrical energy in to mechanical movement. As the high frequency / high voltage is applied to the PZT it changes diameter and thickness in response. The PZT will fail if the power level exceeds 70 watts per PZT long term or if it over heats.

The PZT can be over powered for several reasons.

> Loss of the electrical connections between one of the PZT's and the PCB.

> Incorrect compensation or feedback causing the cleaner to operate at the wrong frequency.

The PZT will over heat by one of the following conditions:

> Low or no water in the tank

> Continuous operation with the tank covered.

> Material lining and insulating the inside bottom of the tank.

2.3.6 Diode/Diode bridge

Diode D4 or the diode bridge D1 are used to rectify the AC line voltage which supplies the FET's. Models 14 and 19 use the single D4 diode and operate half wave. Model 28, 57, and 104 use a full bridge D1 and operate full wave. A FET failure under unusual conditions may cause a failure of the diode or diode bridge because of the fault current.

2.3.7 Zener Diodes

The Zener diodes D2 and D3 clamp the gate voltage to the power FET's. They can be damaged if the FET goes bad. They should be tested if the FET's are replaced. If the PC board area around the diodes is discolored, the feedback is excessive, the feedback toroid L2 and capacitor C4 need to be checked or the compensation capacitor C3 needs to be adjusted.

2.3.8 Feedback Toroid

This toroid L2 provides the feedback signal to make the circuit oscillate. It is not likely to be damaged during operation. Incorrect direction or number of turns that the output inductor wire makes through the toroid center can cause the cleaner to not operate.

2.3.9 Bias and gate resistor

The bias resistor R1 provides the start up voltage for the circuit to oscillate after each AC power line zero crossing. R4&5 control the gate voltage during operation. These devices will not be damaged during normal operation.

The gate resistors R2,3 limit the power FET gate currents and prevent the FET's from oscillating at non-fundamental frequencies. A FET failure can damage these resistors.

2.3.10 Heater

The heater is a silicone pad heater attached to the side of the tank. Operation of the heater without enough solution in the tank may cause it to fail. A continuity

or resistance check of the heater should be made to determine if it's damaged.

2.3.11 Thermal Limiter (Model 28 and larger)
The thermal limiter opens or turns off the power to the heaters when the solution temperature reaches 60°C. It will cycle back on when the temperature drops to approximately 45°C.

**2.4 OPERATIONAL TESTING**
This test is used to gather basic operational information about the cleaner's period, peak current, and wattage.
2.4.1 Disassemble base from cabinet.
2.4.2 Connect the oscilloscope current probe to JMP2 (FET current measurement loop) on PCB.
2.4.3 Fill cleaner 1" from top with water.
2.4.4 Plug in cleaner power cord to the line outlet.

**WARNING:**
**ONCE THE POWER CORD IS PLUGGED IN, VARIOUS COMPONENTS ON THE PCB ARE HAZARDOUSLY LIVE. DO NOT TOUCH ANY COMPONENTS ON THE PCB UNLESS UNIT LINE CORD IS UNPLUGGED.**

2.4.5 Turn on power. Measure the period and peak current. The period and peak current should fall within the operational spec. 3.1.1 and 3.1.4.
2.4.6 Connect cleaner to a RMS wattmeter and measure rms wattage at nominal line voltage sonics only. Check (when configured) heater wattage. Wattage should fall within operational spec. 3.1.2.

**2.5 DIODE TEST**
(NO POWER APPLIED, UNPLUG POWER CORD)
A basic test can be performed on the rectifiers and Zener diodes in the circuit. This will not detect all failure modes.

2.5.1 Select diode test mode on common digital multimeters.

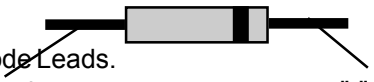


Figure 3 Diode Leads.

2.5.2 Touch test leads to diode leads and check forward conduction through diode.

2.5.3 The meter reading should be between 0.4 and 0.8 volts DC. An open circuit, high voltage, or a short indicates a diode failure.

**2.6 POWER FET TEST**
(NO POWER APPLIED, UNPLUG POWER CORD)
This test will not detect all FET failure modes.
2.6.1 Select diode test mode on common digital multimeters.

2.6.2 Touch test leads to FET leads and check conduction through FET.

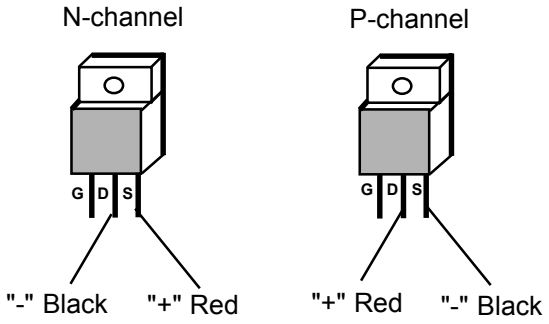


Figure 4 FET Leads:

2.6.3 The D (Drain) to S (Source) measurement should be 0.4 - 0.8 VDC.

2.6.4 A reading outside this window or range indicates a faulty device.

**2.7 CAPACITOR COMPENSATION ADJUSTMENT**
The compensation capacitor is used to maximize the resonant frequency performance of the cleaner by adjusting for differences between tanks and piezo disks. A particular size and voltage of tank will normally require the same size of compensation cap.

Tanks will normally be shipped from the factory with a compensation capacitor already selected and attached to the wiring.

**CAUTION:**
**THE MEASUREMENT AND ADJUSTMENT BELOW ARE TO BE PERFORMED AFTER THE PIEZO DISK HAS COOLED DOWN TO ROOM TEMPERATURE AND COLD WATER IS IN THE TANK.**

2.7.1 Use the current probe (Section 2.4.5) to verify that the period falls within operational specification 3.1.1.

2.7.2 If less than 20 µsec (micro seconds), change compensation capacitor to the next larger size capacitor. Reference Table 2.7.1

2.7.3 If greater than 22 µsec (micro seconds) or too much current cut-in (see Section 2.7.4), reduce compensation capacitor to next smaller size. (Not on 136, 208)

Table 2.7.1 Standard Compensation capacitor sizes

| Capacitor | Ney P/N |
|---|---|
| 1.2 nF | 94-92-023 |
| 2.2 nF | 94-92-024 |
| 3.3 nF | 94-92-027 |
| 4.7 nF | 94-92-028 |
| 5.6 nF | 94-93-056 |
| 6.8 nF | 94-92-031 |
| 8.2 nF | 94-92-032 |
| 10 nF | 94-92-035 |
| 12 nF | 94-92-036 |

Use only the approved capacitors above. The substitution of lower grade capacitors will cause tank and/or PC board failure.

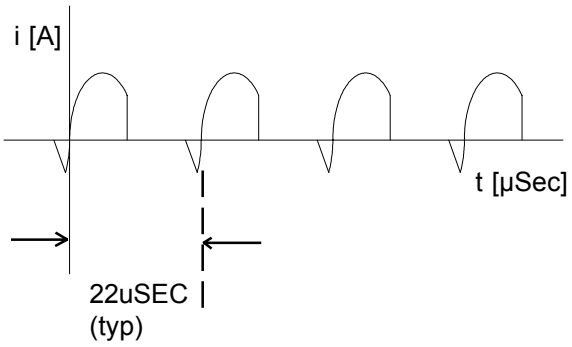



Figure 5 Excess current cut-in (COLD WATER). Reduce compensation capacitor one value.

2.7.4 Current through N-channel FET (measured at current loop.

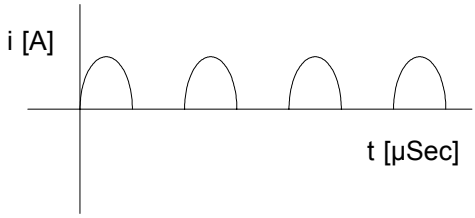



Figure 6 No current cut-in (Cold water). Good operation, do not adjust compensation cap.

- If cleaner has low activity, increase the compensation capacitor one value (decrease on 136 and 208 model).

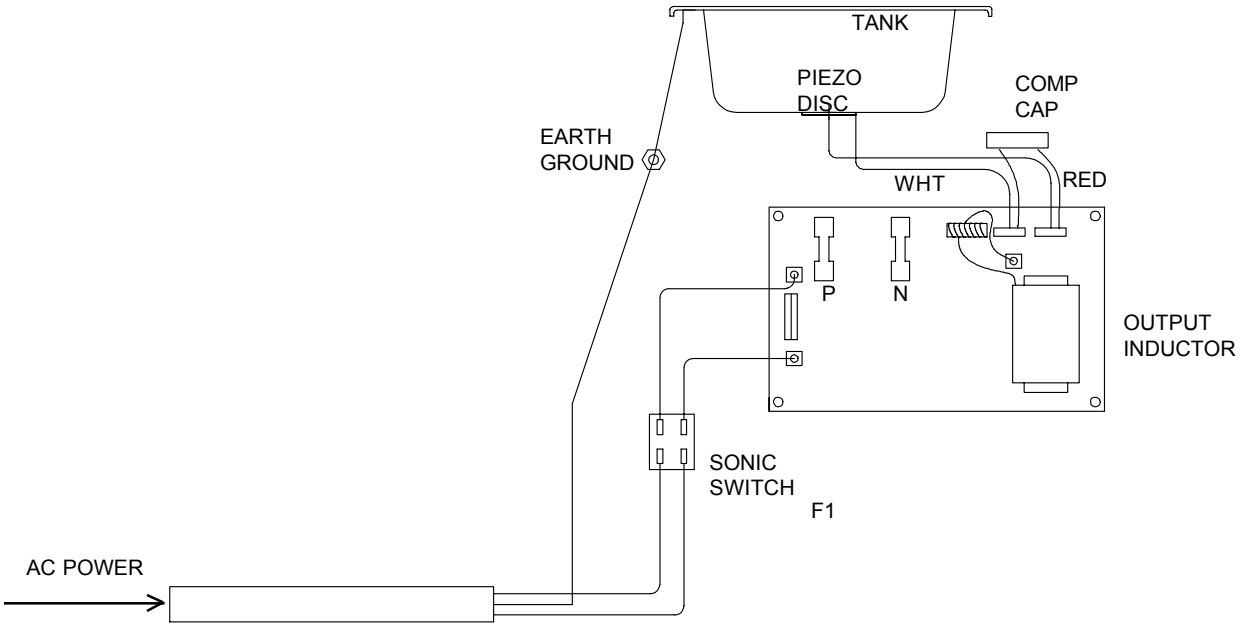
- If cleaner has a discolored PC board or FET from over temperature reduce the compensation capacitor one value if the tank is not being changed.

The changing of a tank or compensation capacitor on a cleaner requires that the cleaner be tested for correct operation under various conditions.

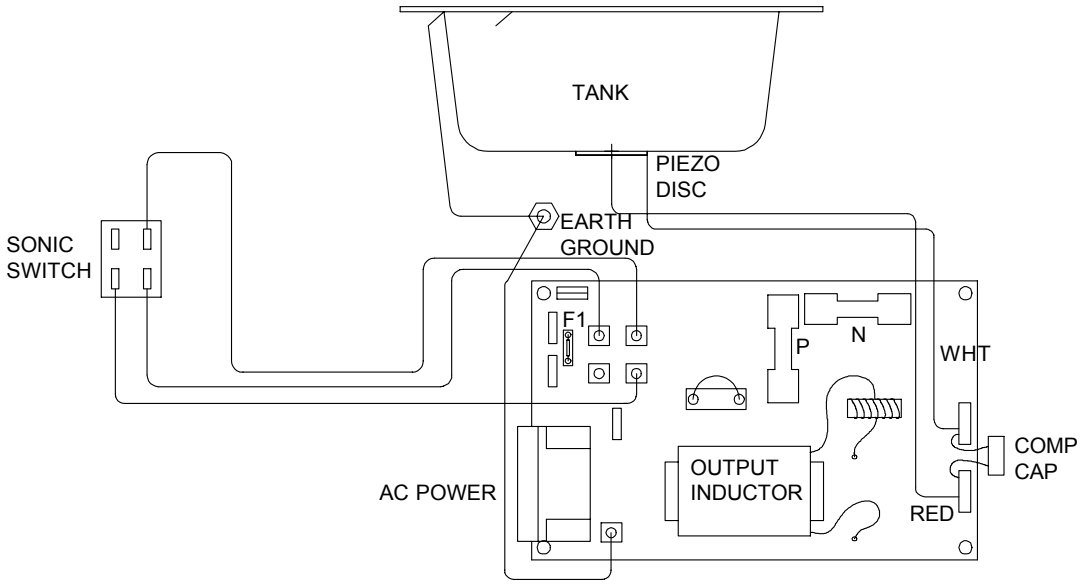
Cold Startup: Cold water in tank, low line voltage, turn on cleaner and check for activity after 5 minutes.

Hot Running: Hot water in tank, high line voltage, run cleaner for 2 hours to verify that cleaner will not go over power.

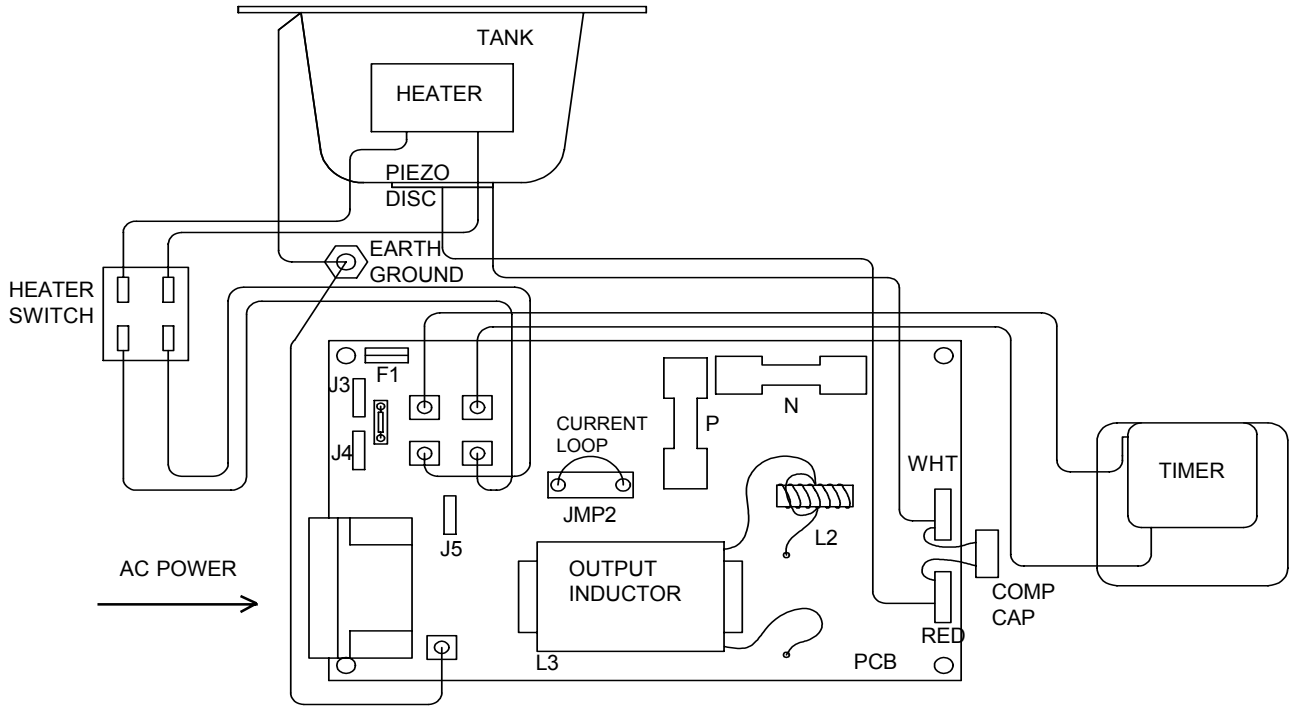
## 2.8 WIRING DIAGRAMS



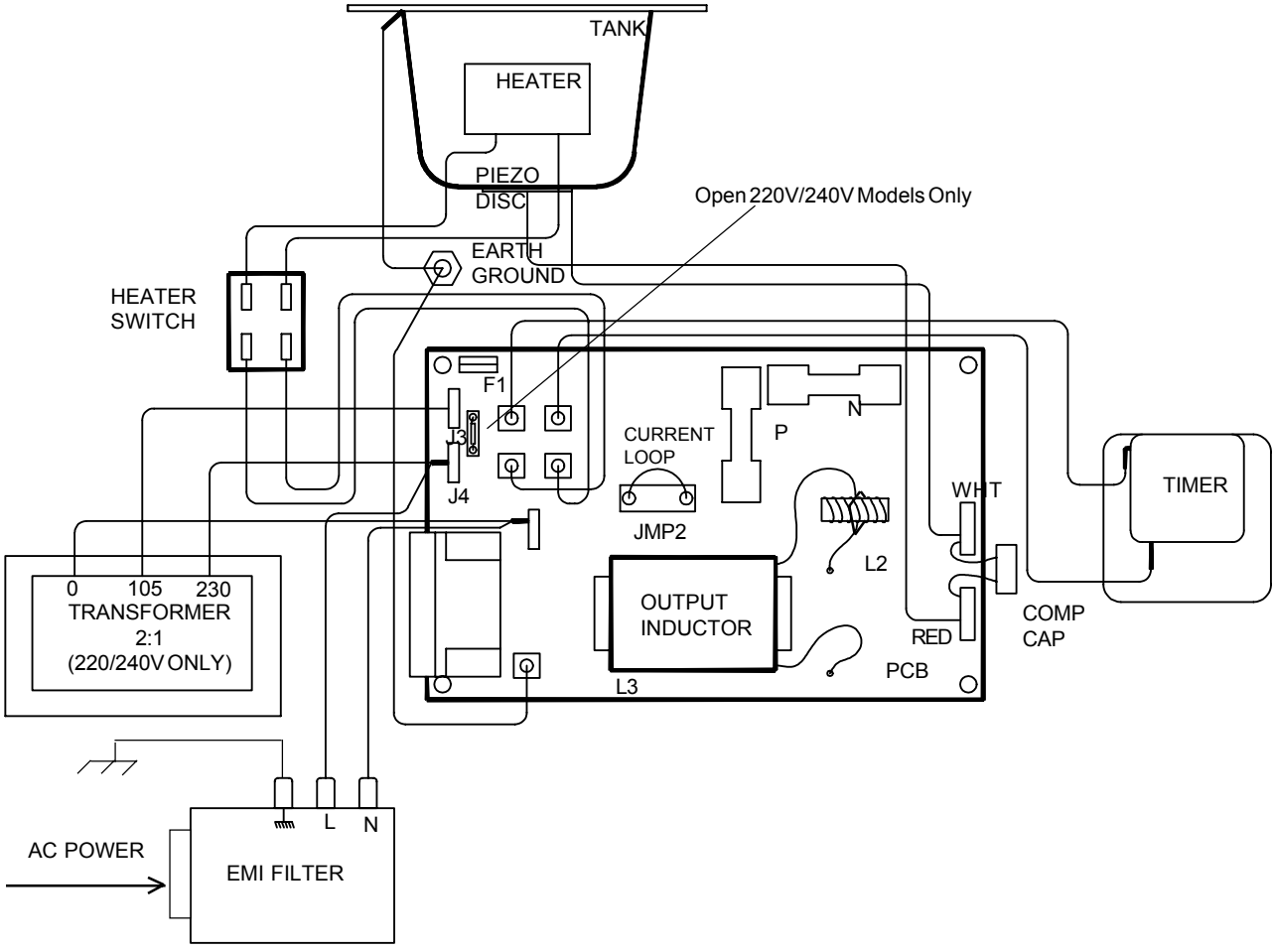

### 2.8.1 Model 5B (120V)



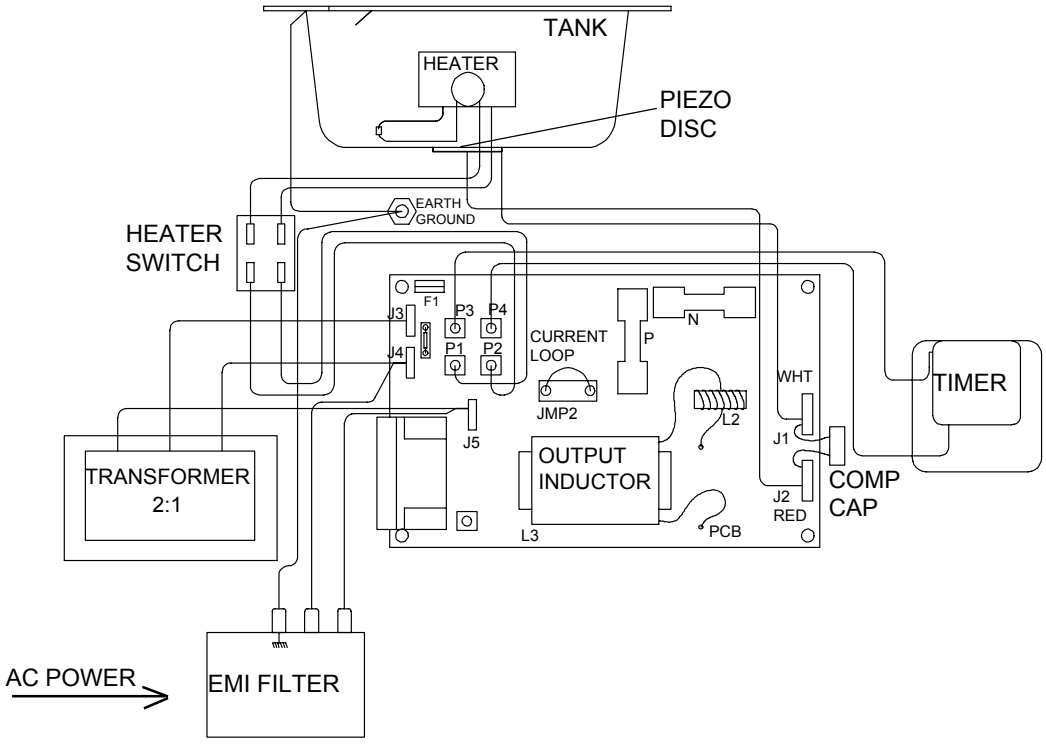

### 2.8.2 Model 14B (120V) - No Timer



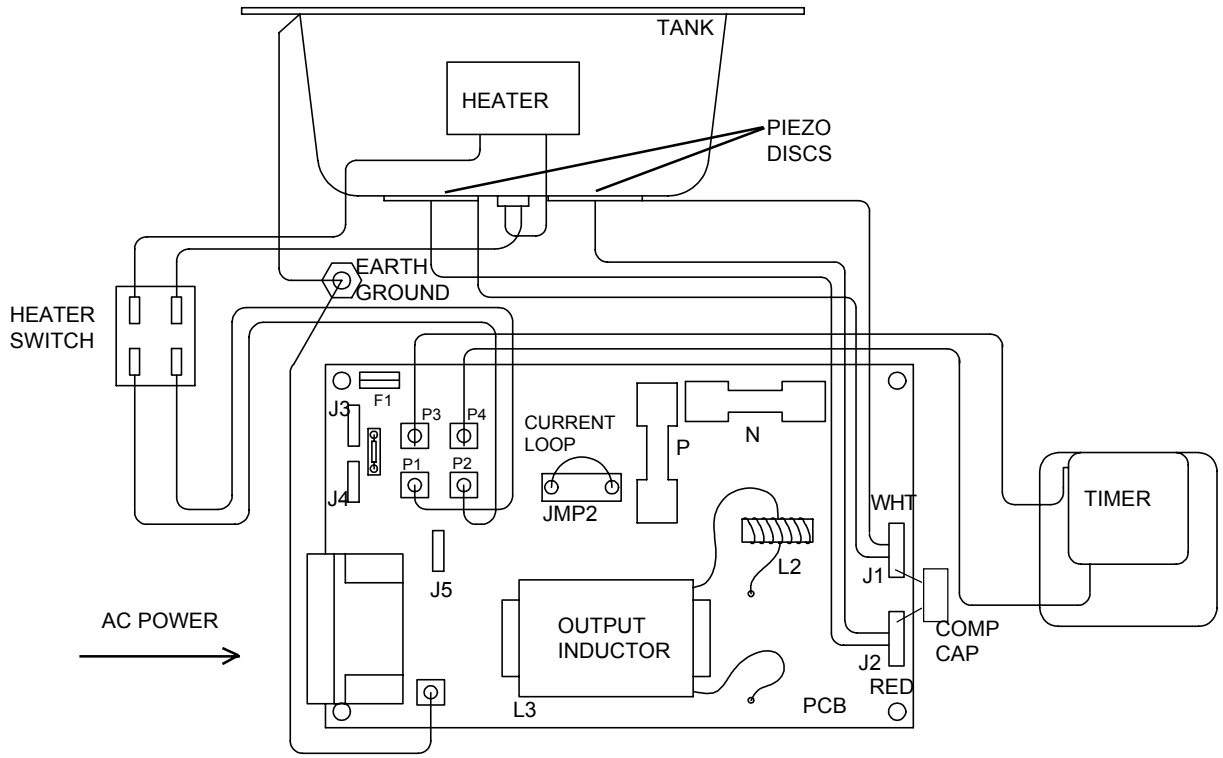

**2.8.3 Models 14H and 19H (120V)**



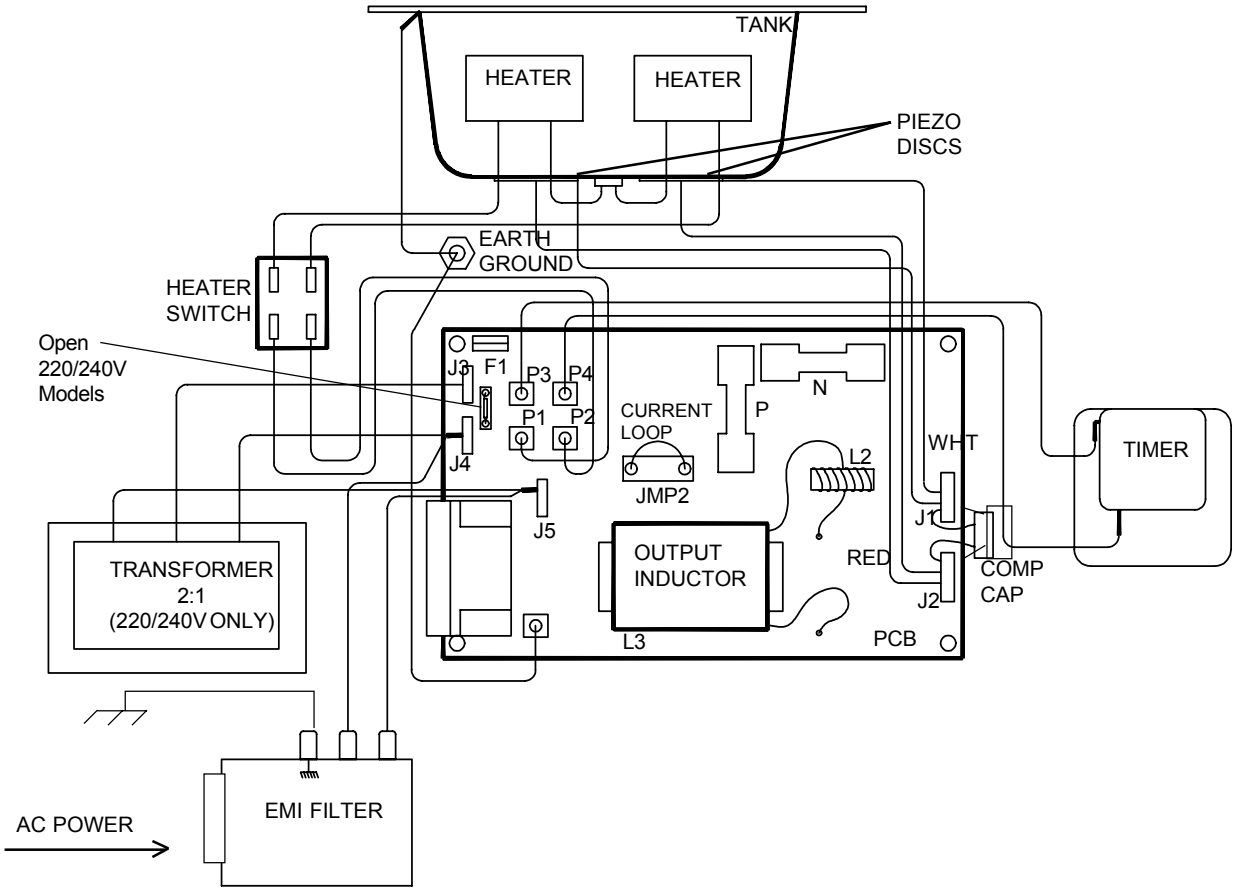

**2.8.4 Models 14H and 19H (100/220/240V)**



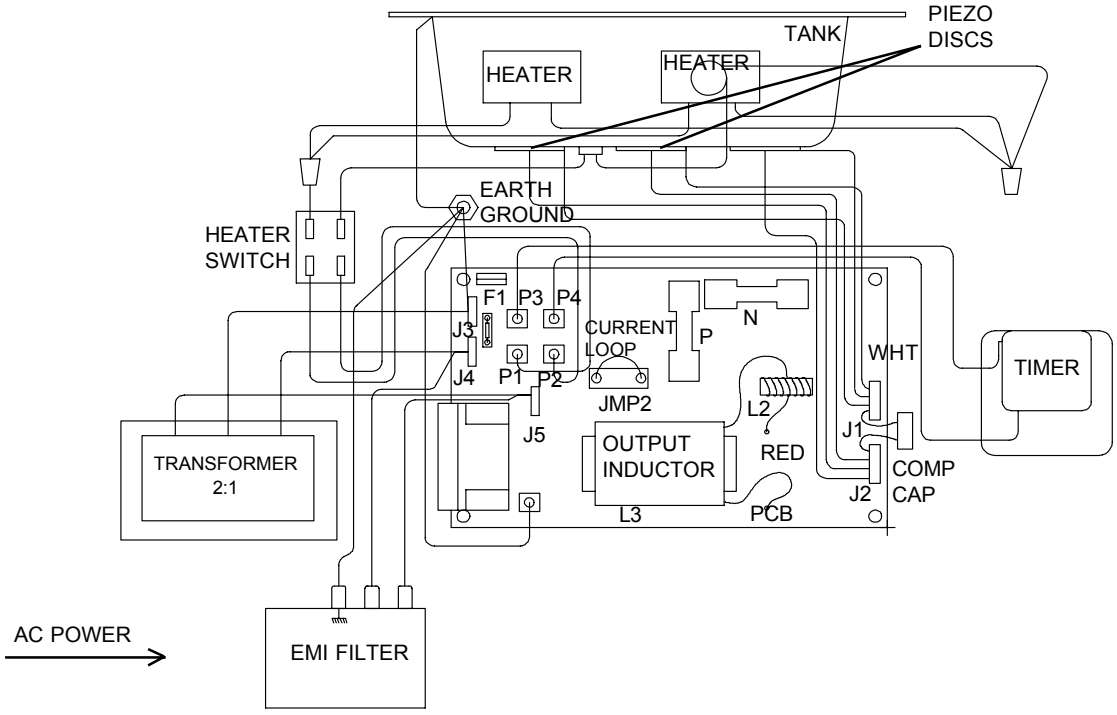

**2.8.5 Models 14H and 19H (230V)**



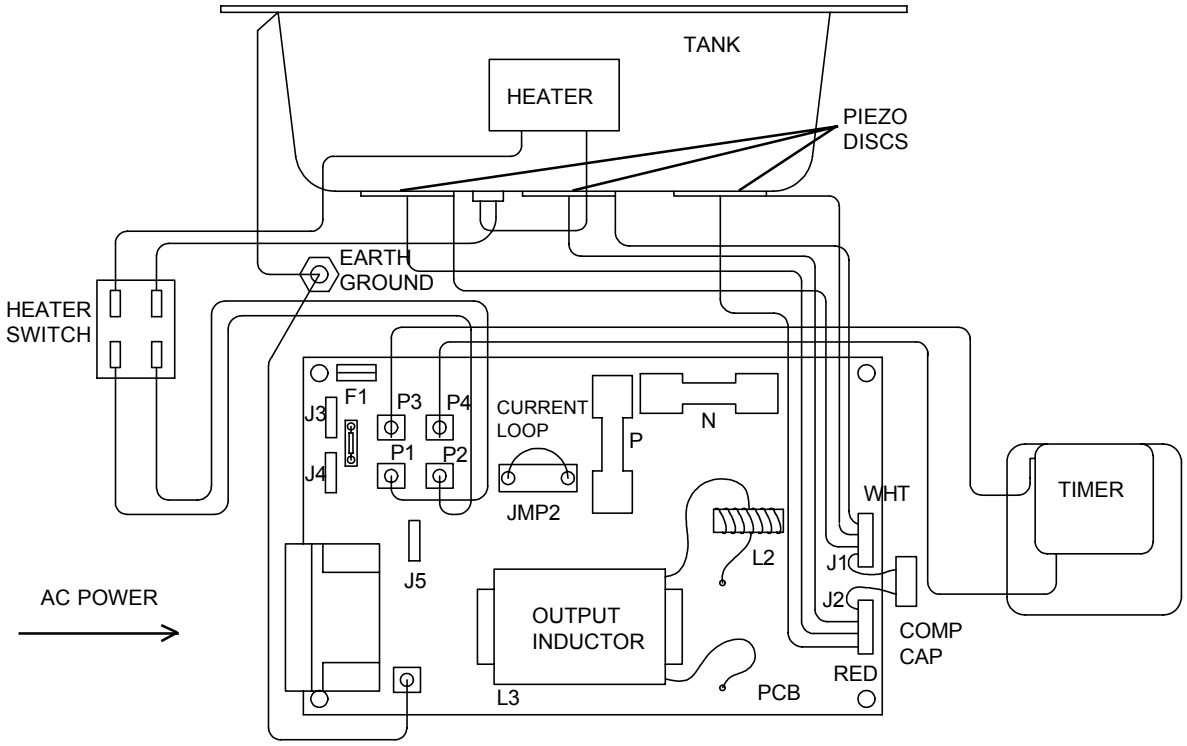

**2.8.6 Model 28H (120V)**



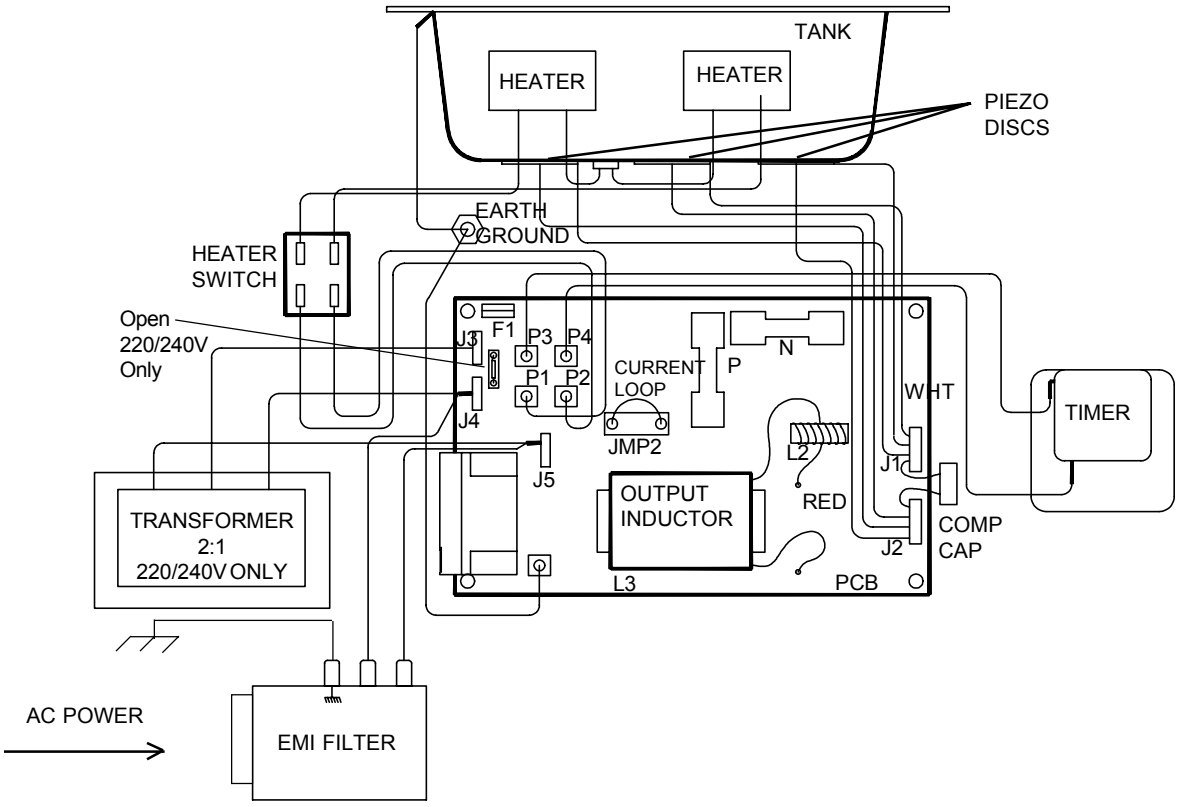

**2.8.7 Model 28H (100/220/240V)**



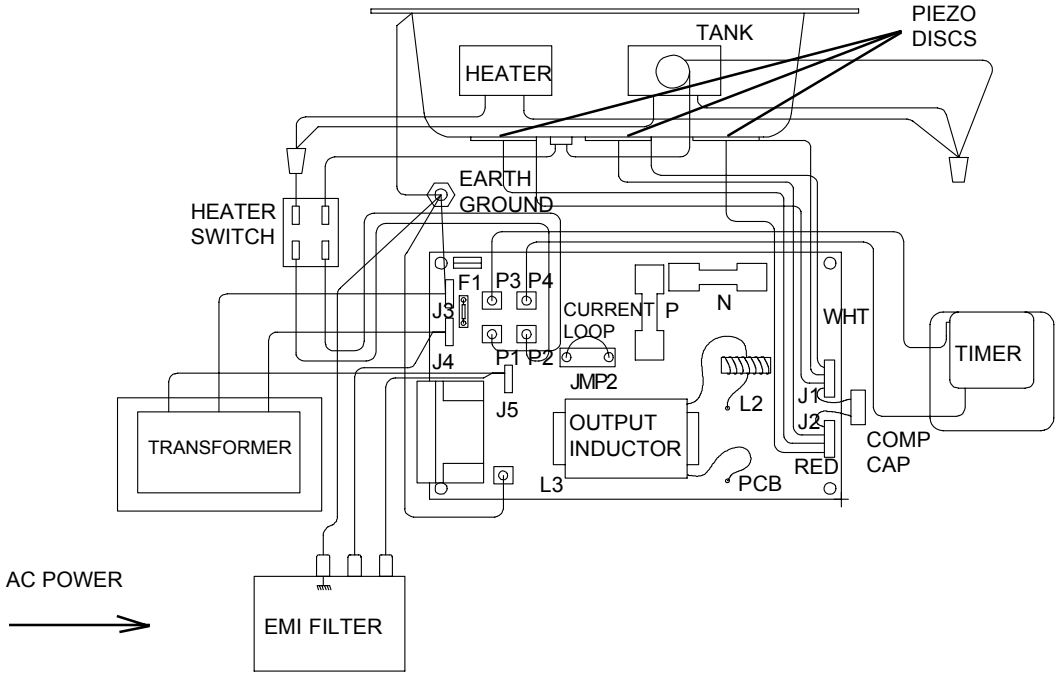

**2.8.8 Model 28H (230V)**



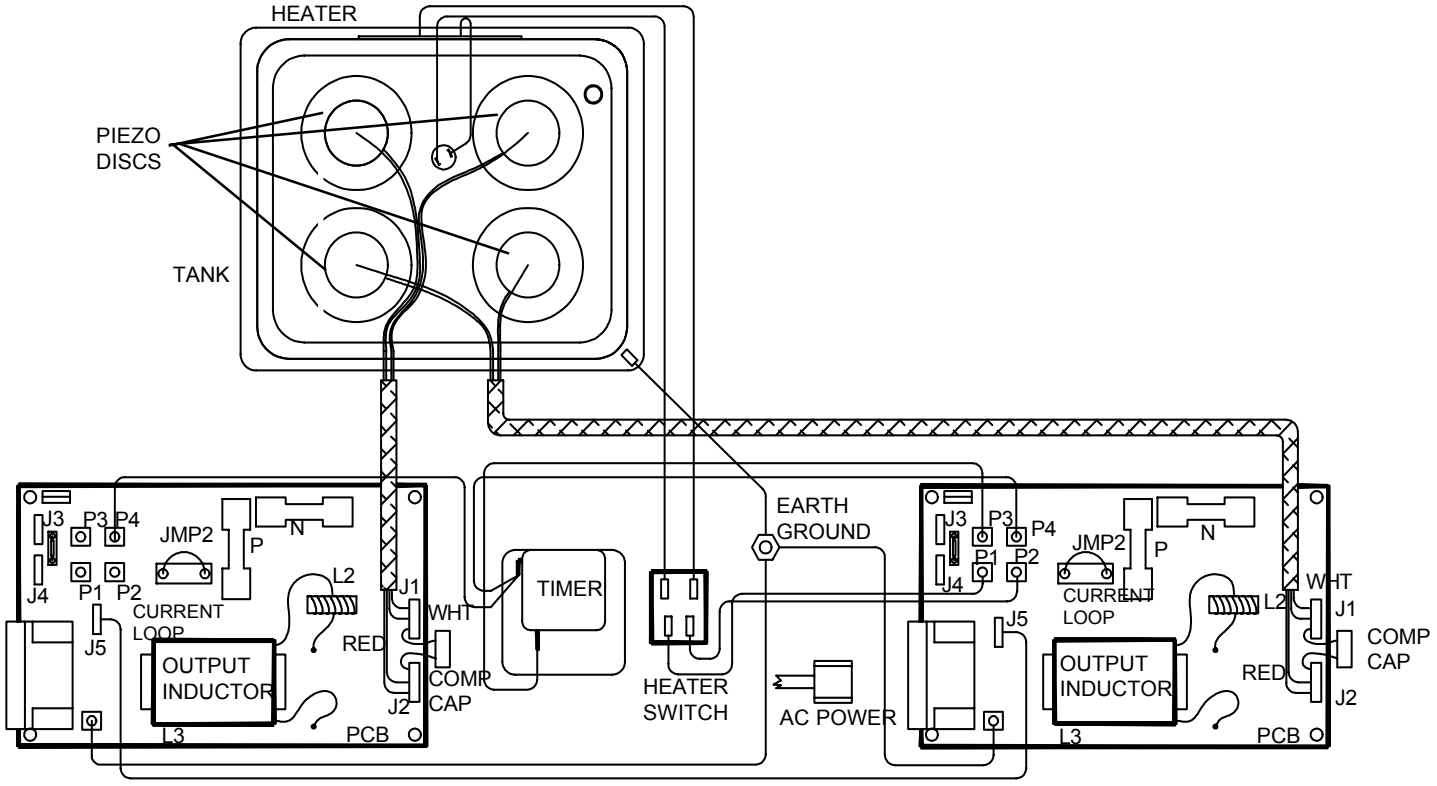

**2.8.9 Model 57H (120V)**



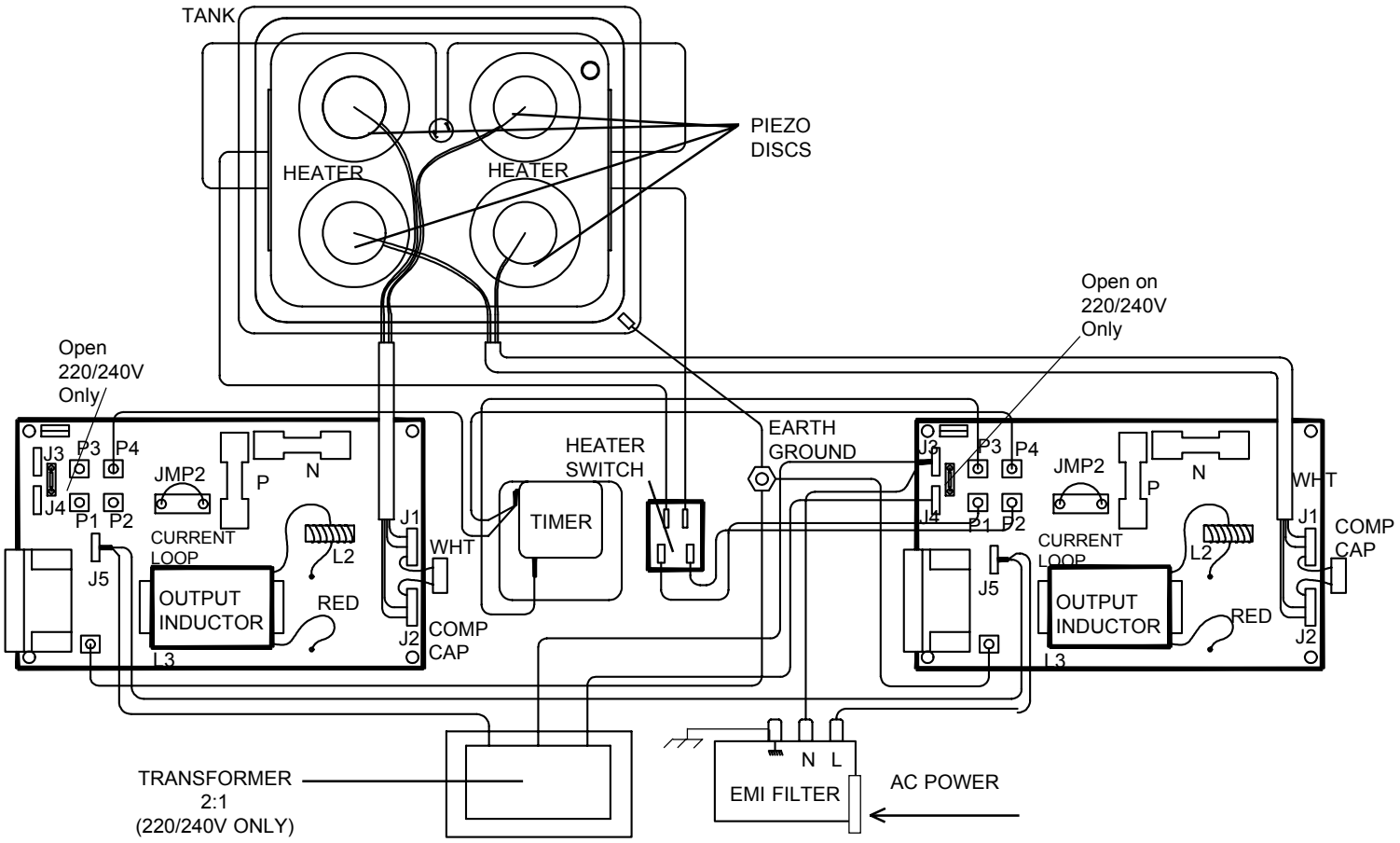

**2.8.10 Model 57H (100/220/240V)**



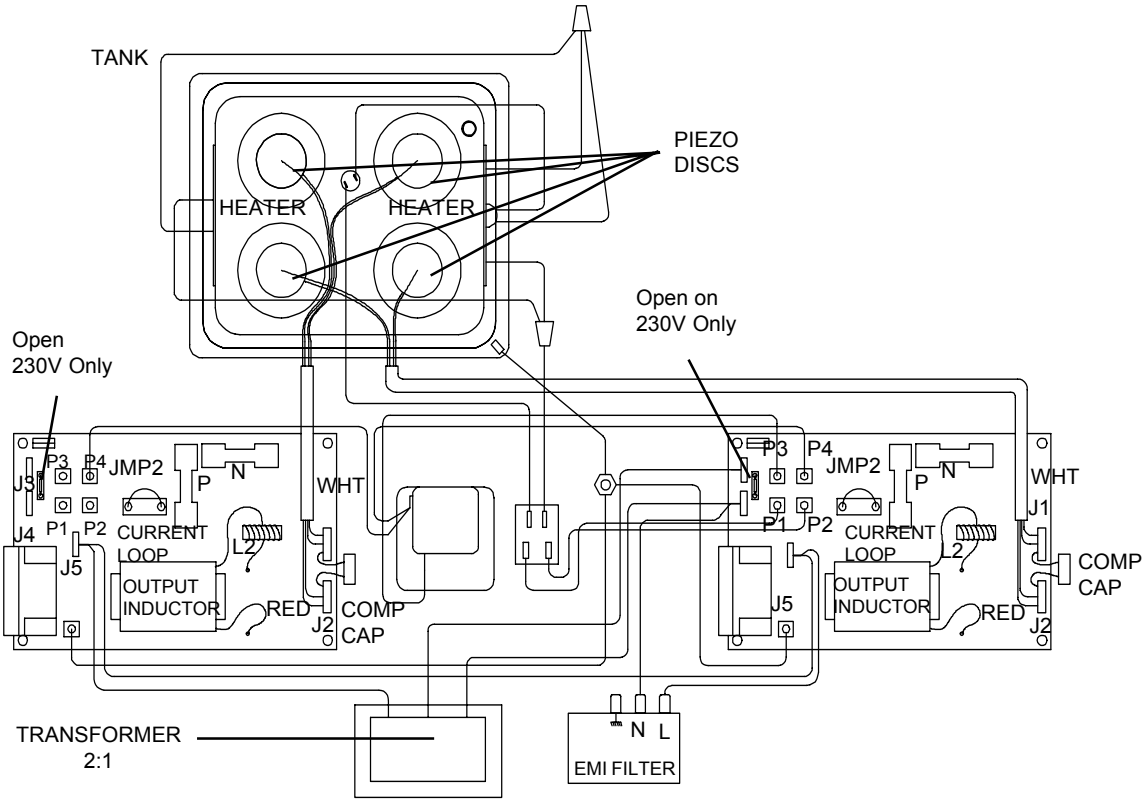

**2.8.11 Model 57H (230V)**



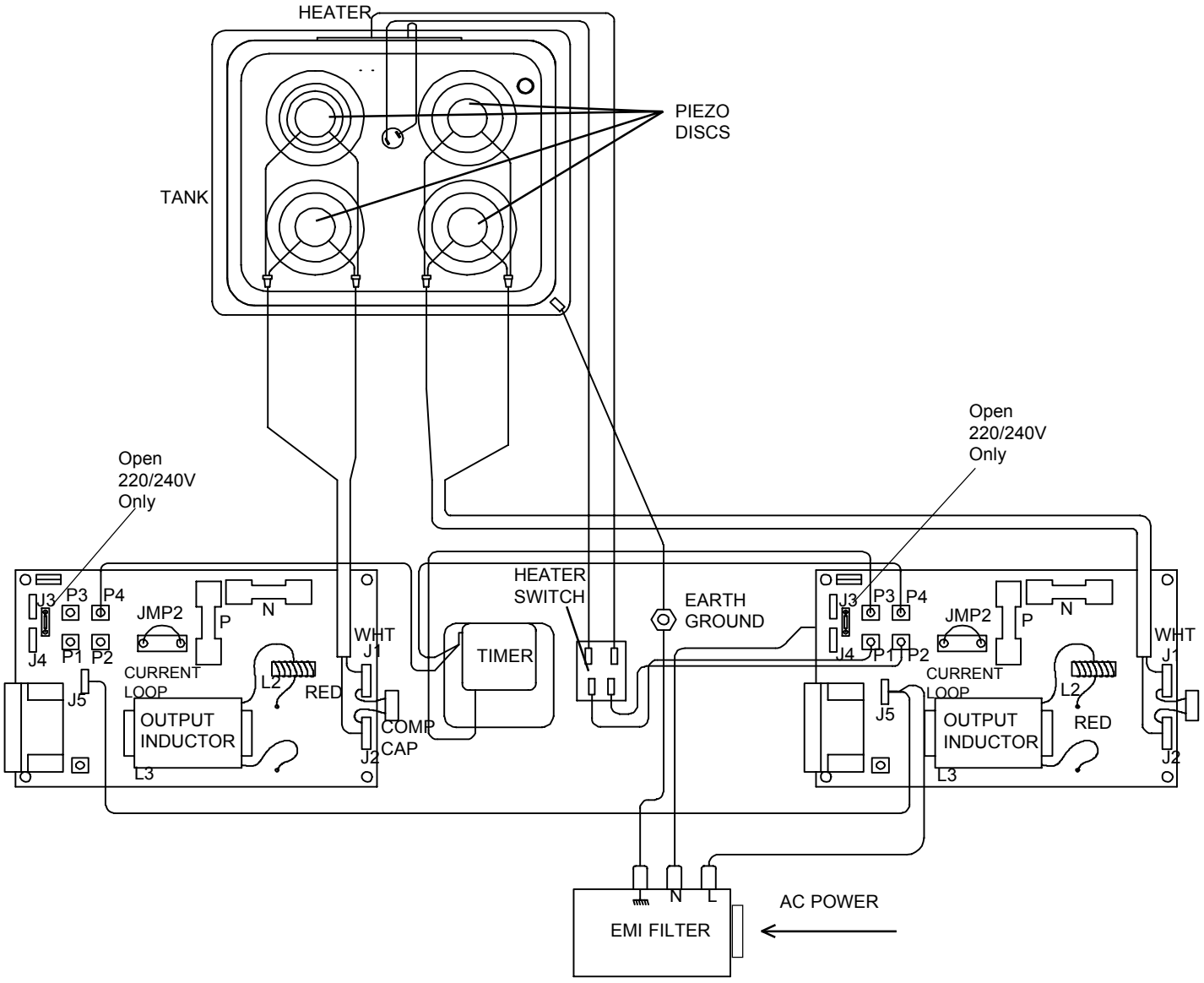

**2.8.12 Model 104H (120V)**



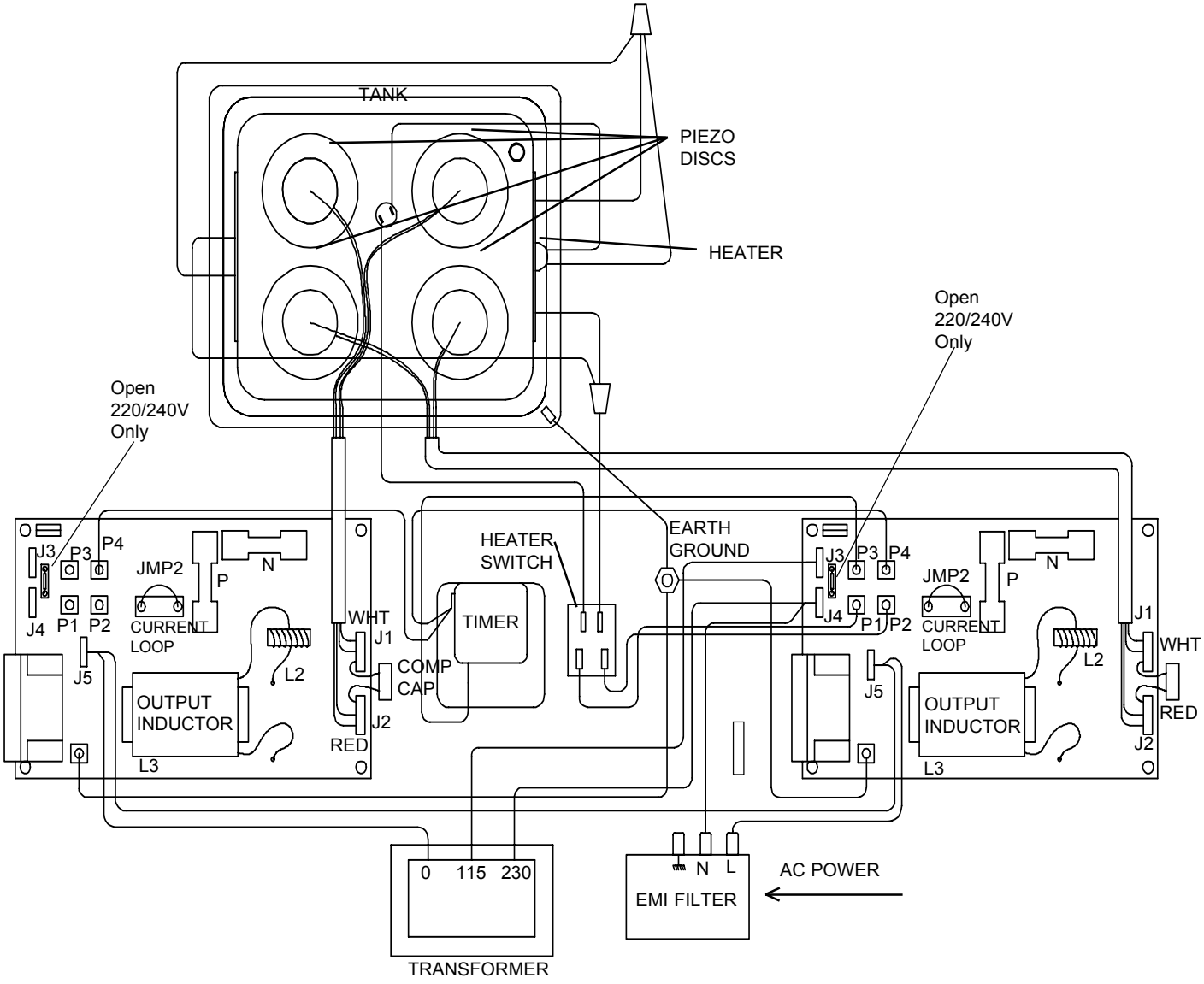

**2.8.13 Model 104H (100/220/240V)**



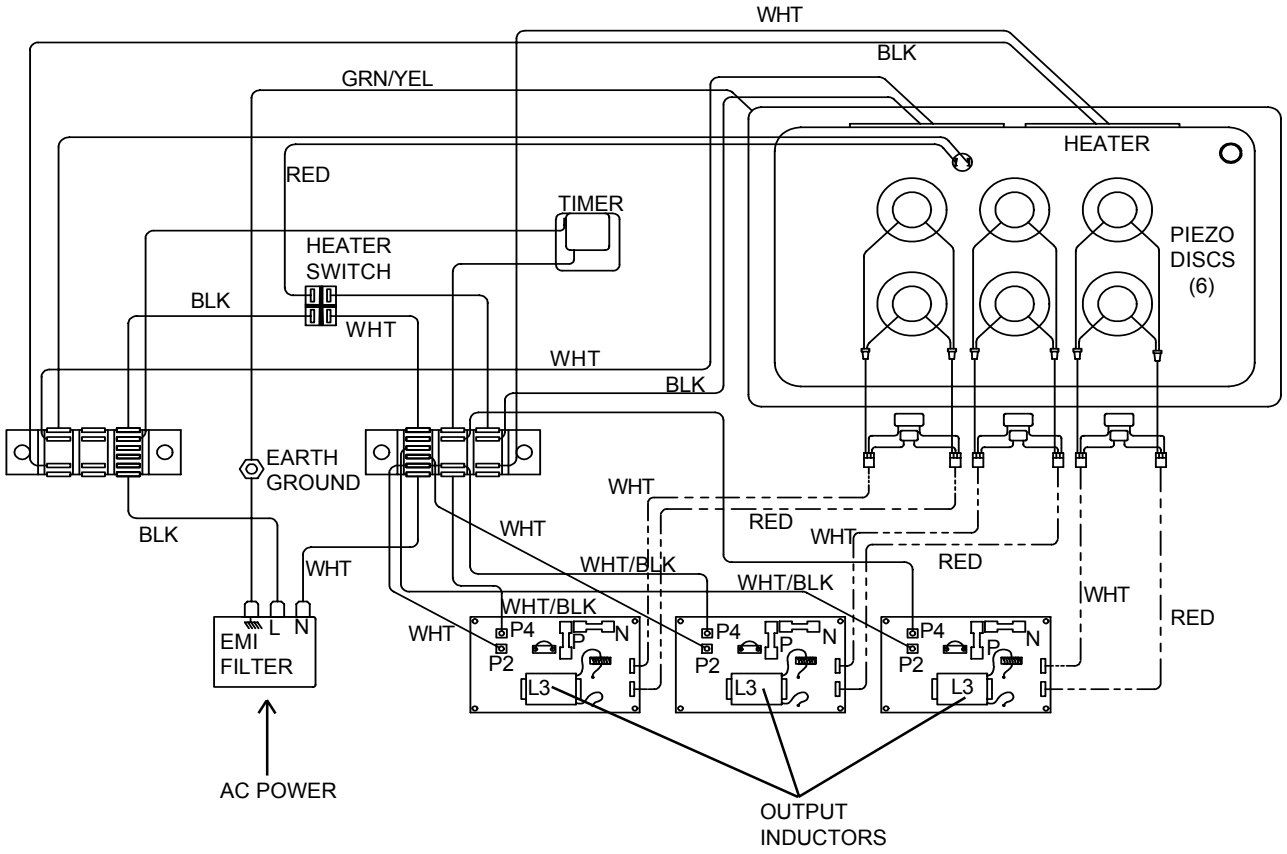

**2.8.14 Model 104H (230V)**



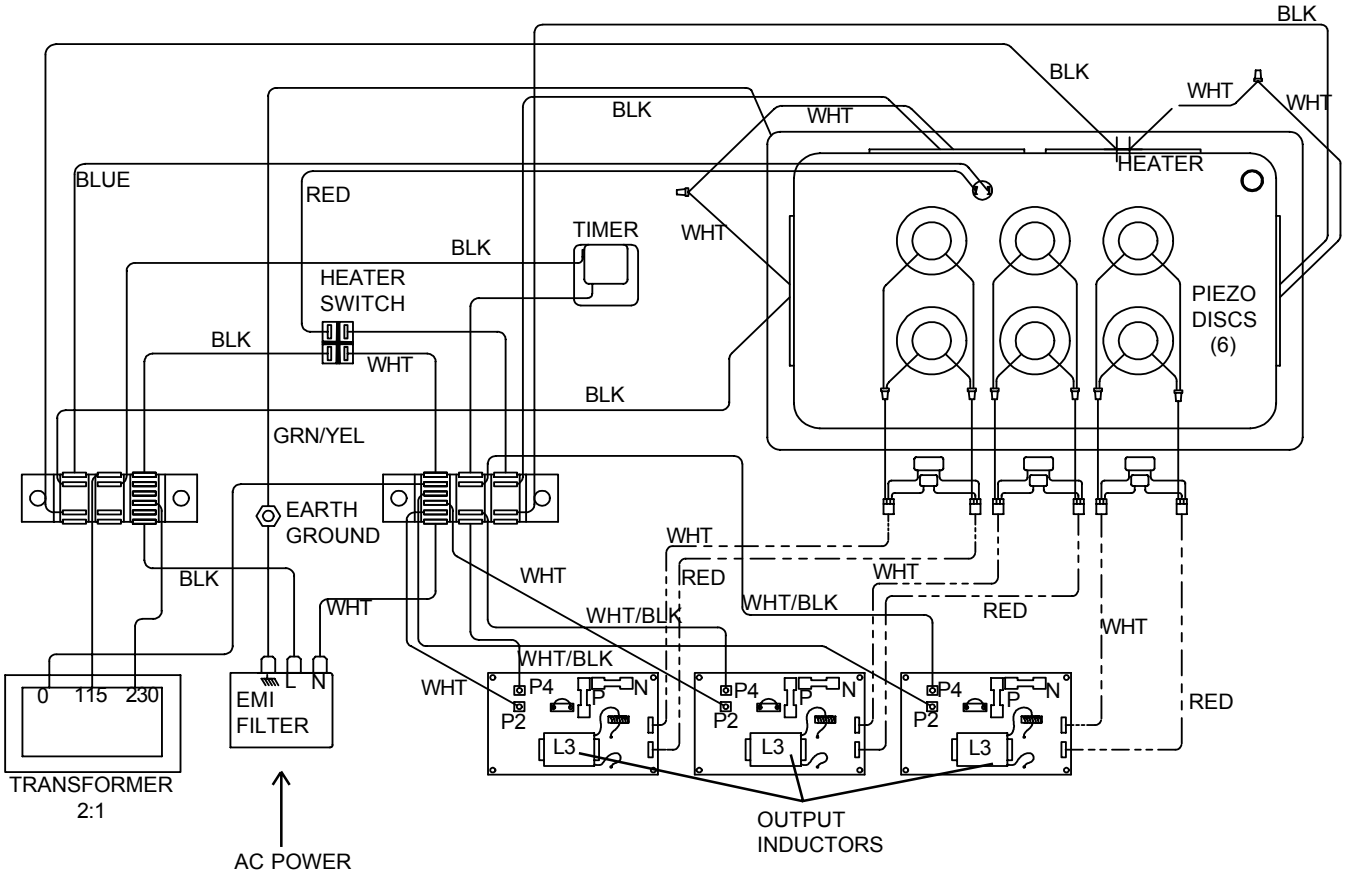

**2.8.15 Model 136H (100V)**



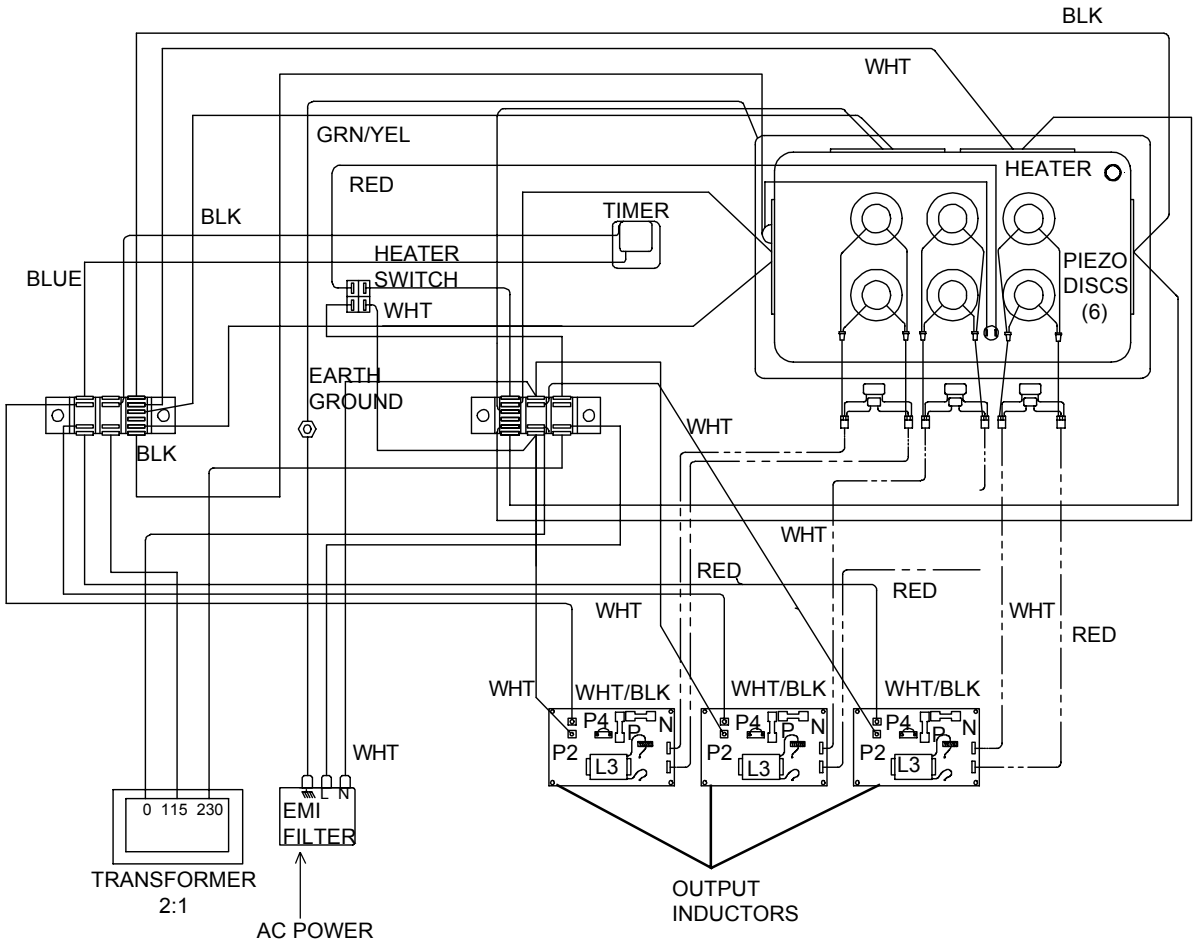

**2.8.15 Model 136H (230V)**




**2.8.16 Model 208H (100/120V)**



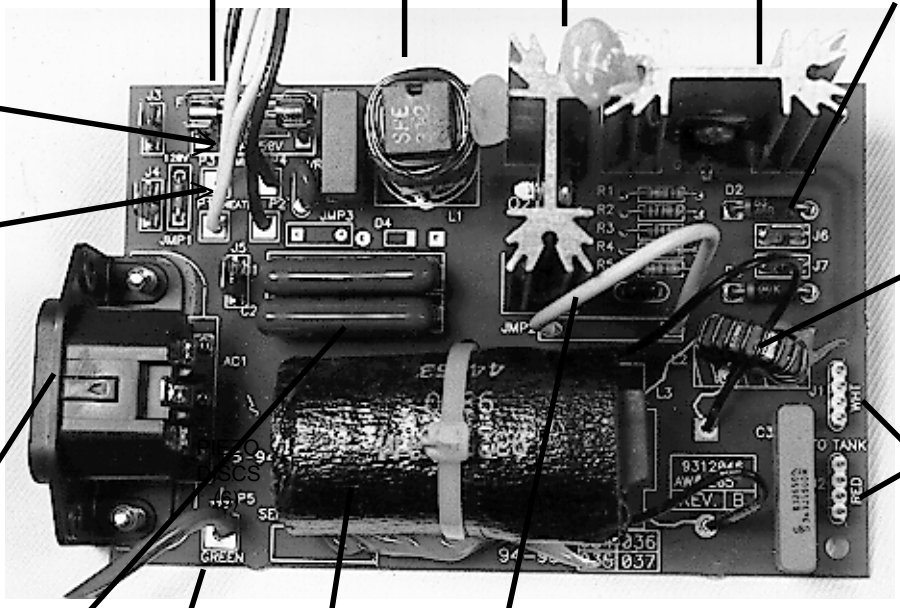

**2.8.17 Model 208H (220/240V)**




**2.8.18 Model 208H (230V)**

**2.9 COMPONENT IDENTIFICATION**

(Model 28 PCB Shown)



# SECTION 3
# SPECIFICATIONS

## 3.1 OPERATIONAL SPECIFICATIONS

Equipment: - Oscilloscope with current probe.
- Wattmeter.

Conditions: - Water level 1" from top of tank.
- Nominal Line Voltage

### 3.1.1 Period (1/Frequency):

**100V & 220V**

| Model | Period COLD | Period HOT* |
|---|---|---|
| 5 | 21-23 µSec | <26 µSec |
| 14 | 21-23 µSec | <26 µSec |
| 19 | 21-23 µSec | <26 µSec |
| 28 | 21-23 µSec | <26 µSec |
| 57 | 21-23 µSec | <26 µSec |
| 104 | 21-23 µSec | <26 µSec |
| 136 | 21-23 µSec | <26 µSec |
| 208 | 22-25 µSec | <26 µSec |

**120V, 230V & 240V**

| Model | Period COLD | Period HOT* |
|---|---|---|
| 5 | 21-22 µSec | <25 µSec |
| 14 | 21-22 µSec | <25 µSec |
| 19 | 21-22 µSec | <25 µSec |
| 28 | 21-22 µSec | <25 µSec |
| 57 | 21-22 µSec | <25 µSec |
| 104 | 21-22 µSec | <25 µSec |
| 136 | 21-22 µSec | <25 µSec |
| 208 | 21-25 µSec | <26 µSec |

* < Denotes less than

### 3.1.2 Sonic Power: (Heater off)

| Model | Power, COLD Water | Power, HOT Water |
|---|---|---|
| 5 | 25-30 Watts | 30-40 Watts |
| 14 | 40-60 Watts | 45-60 Watts |
| 19 | 40-60 Watts | 45-60 Watts |
| 28 | 70-100 Watts | 90-120 Watts |
| 57 | 115-135 Watts | 120-150 Watts |
| 104 | 160-200 Watts | 170-220 Watts |
| 136 | 170-210 Watts | 170-220 Watts |
| 208 | 280-310 Watts | 290-330 Watts |

### 3.1.3 Heater Power:

| Model | 120V | 240V |
|---|---|---|
| 14 | 40 W | 40 W |
| 19 | 40 W | 40 W |
| 28 | 60 W | 120 W |
| 57 | 110 W | 220 W |
| 104 | 200 W | 400 W |
| 136 | 200 W | 400 W |
| 208 | 400 W | 800 W |

** Peak current are max. values taken across white wire current loop.

### 3.1.4 Current:

| Model | Peak Current ** |
|---|---|
| 5 | 3.5-5.5A |
| 14 | 3.5-5.5A |
| 19 | 3.5-5.5A |
| 28 | 3-5A |
| 57 | 4-6A |
| 104 | 3-5A per Board |
| 136 | 3-5A per Board |
| 208 | 3-5A per Board |

### 3.1.5 Compensation Capacitor:

Table 1: Nominal Compensation Capacitors for Cleaners at various line voltages.

| | VOLTAGE | | | | |
|---|---|---|---|---|---|
| MODEL | 100V | 120V | 220V | 230V | 240V |
| 5B | --- | 4.7nF | --- | --- | --- |
| 14B/H 19B/H | 12nF | 5.6nF | 6.8nF | 5.6nF | 5.6nF |
| 28B/H | 6.8nF | 3.3nF | 6.8nF | 3.3nF | 3.3nF |
| 57B/H | 10nF | 4.7nF | 10nF | 4.7nF | 4.7nF |
| 104B/H | 4.7nF | 3.3nF | 4.7nF | 3.3nF | 3.3nF |
| 136B/H | 12+3.3nF | 12+3.3nF | --- | 2+3.3nF | --- |
| 208B/H | 12+3.3nF | 12+4.7nF | 12+3.3nF | 12+3.3nF | 12+3.3nF |

## 3.2 MECHANICAL SPECIFICATIONS

See product manual for outline dimensions and weights.

# SECTION 4
# SERVICE PARTS

## 4.1 ORDERING INSTRUCTIONS

To order parts, select the part number from the exploded view drawings in sections 4.2 through 4.5. When ordering parts please have the following information available:

1. Serial number of cleaner.
2. Date purchased.
3. Where purchased.
4. Symptom of failure.
5. Part number of replacement part.
6. Preferred method of shipment.

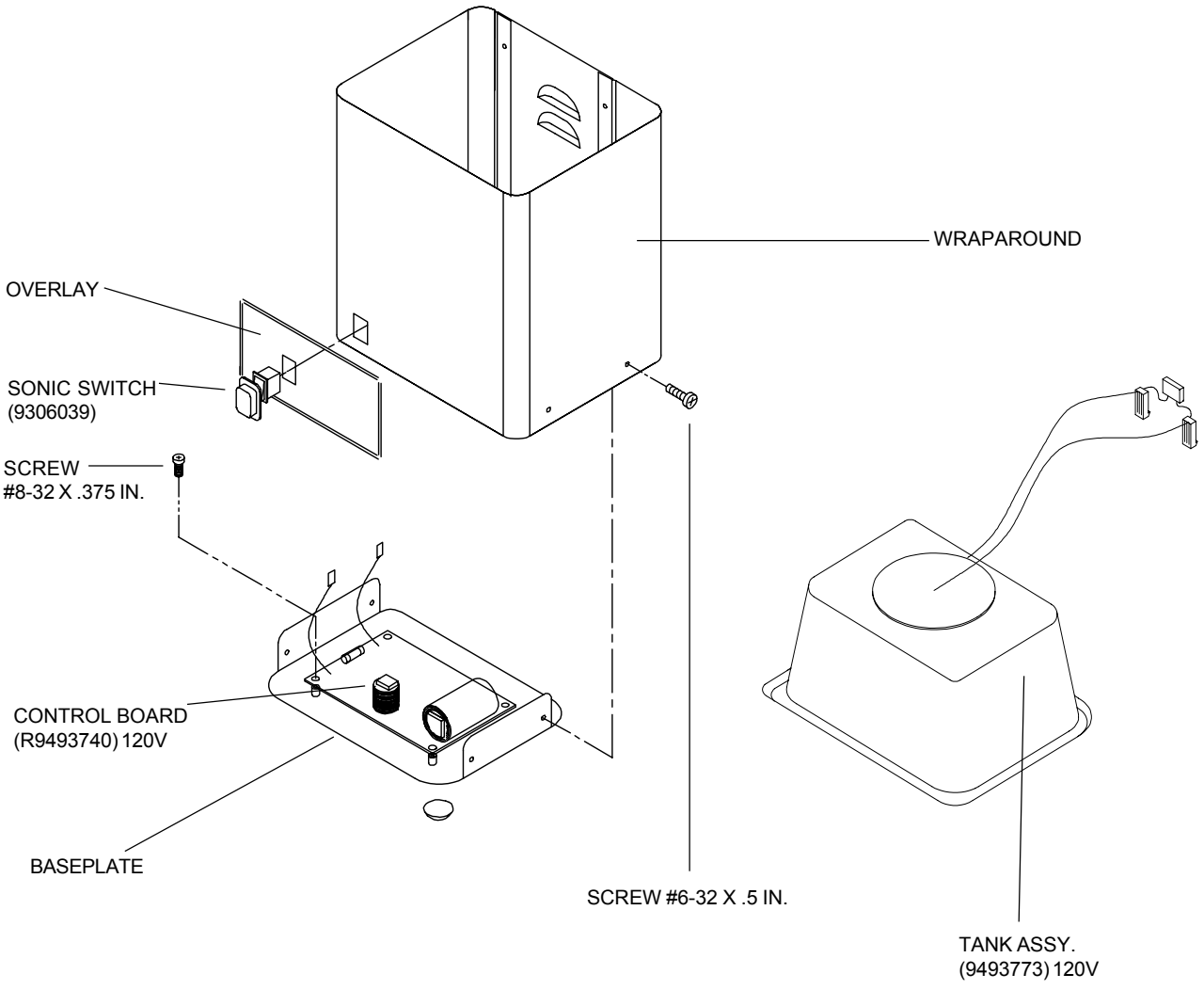
GENERAL PARTS AND SUPPLIES

Hardware Kit P/N: 94-93-158
(Contains: complete set of screws, nuts, and other hardware used on the cleaners)

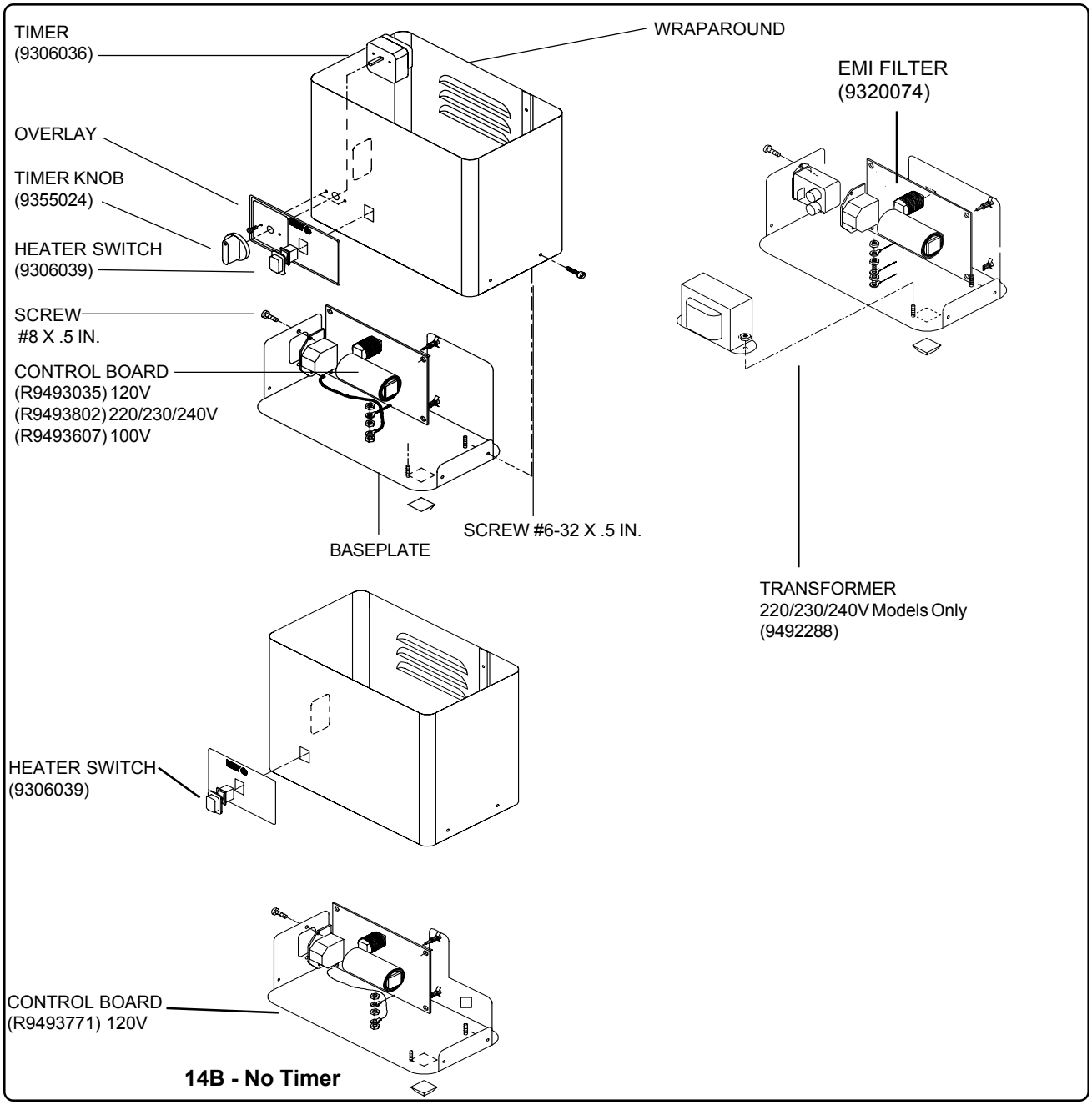
Adhesive, Silicone Clear P/N: 91-07-025A
Used to attach the tank to the cabinet and the thermal limiter switch to the bottom of the tank. Also referred to as RTV.

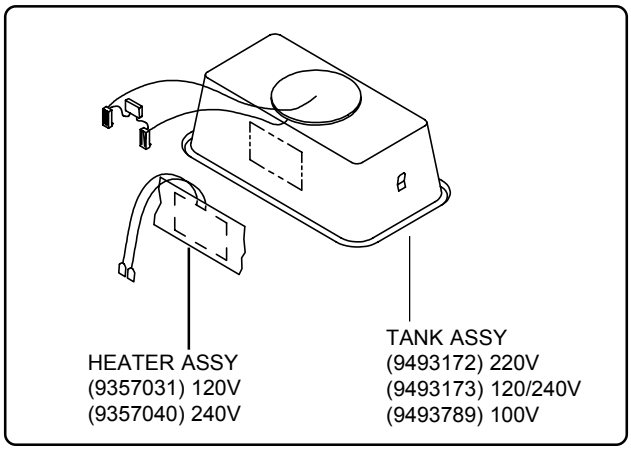
## 4.2 SERVICE PART DRAWINGS

### 4.2.1 MODEL 5 SERVICE PARTS

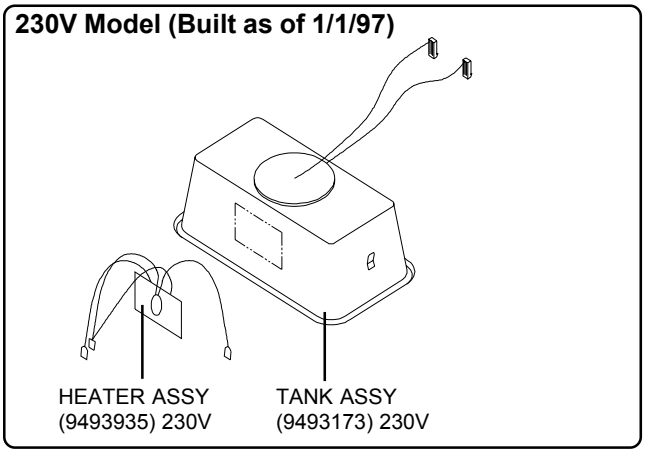


### 4.2.2 MODEL 14 SERVICE PARTS

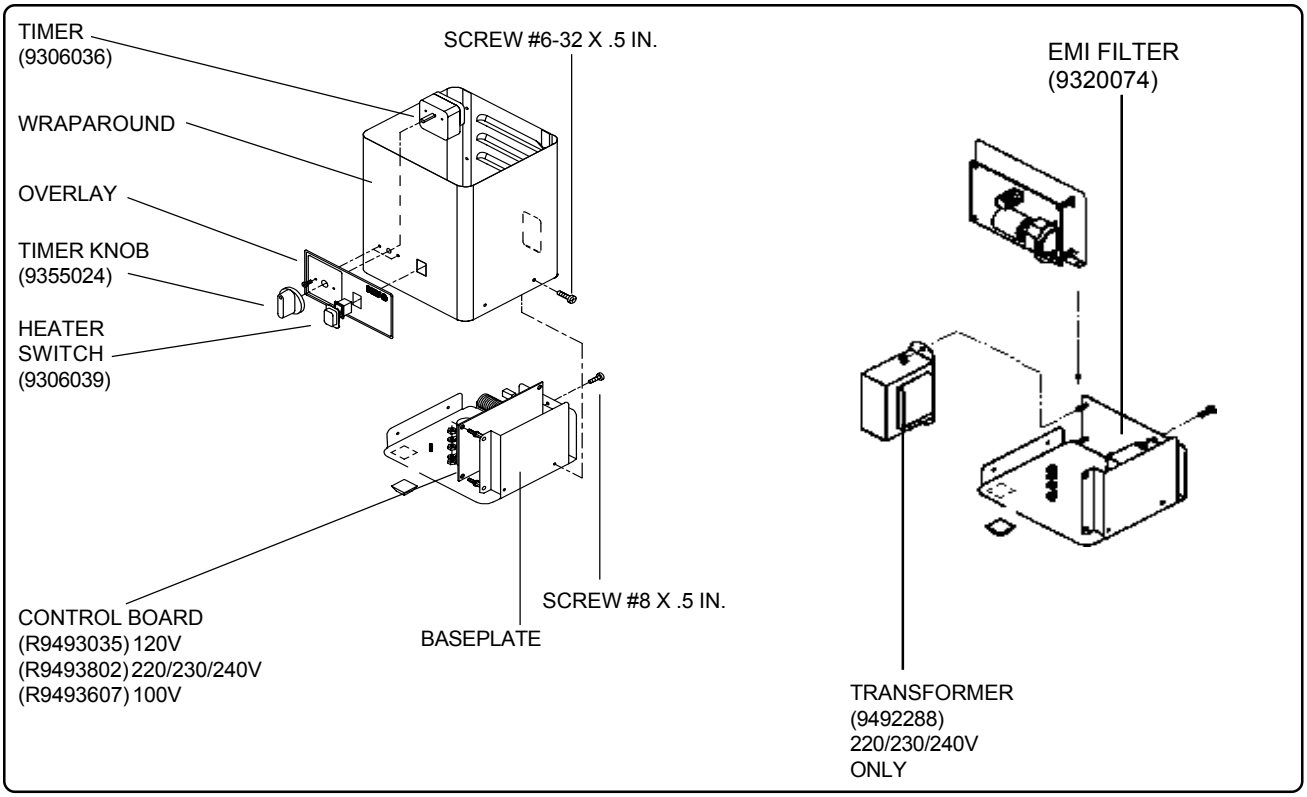


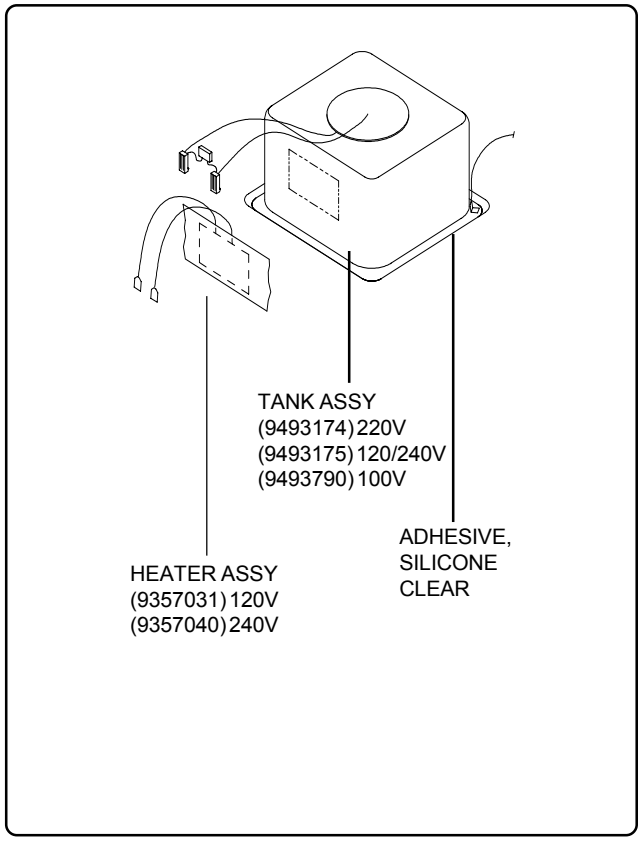



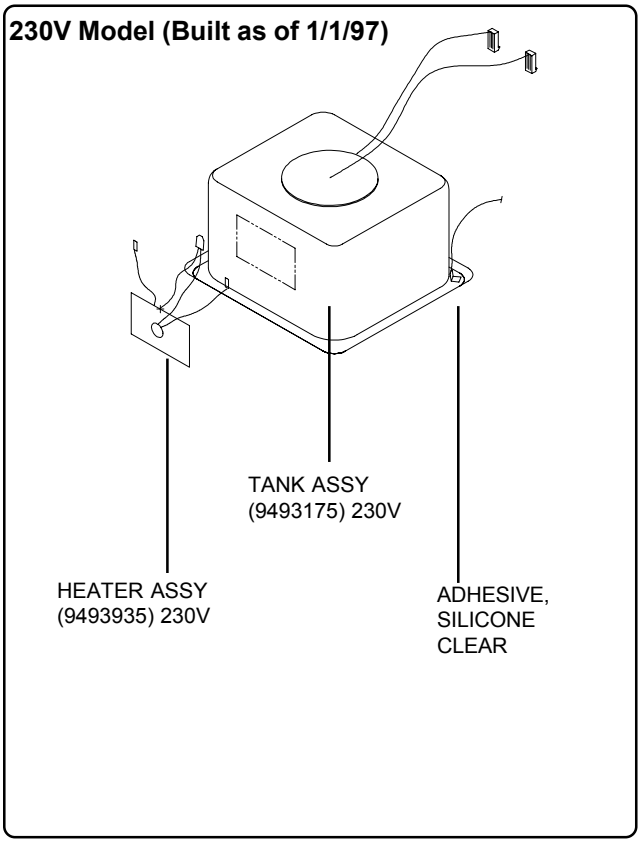

**230V Model (Built as of 1/1/97)**



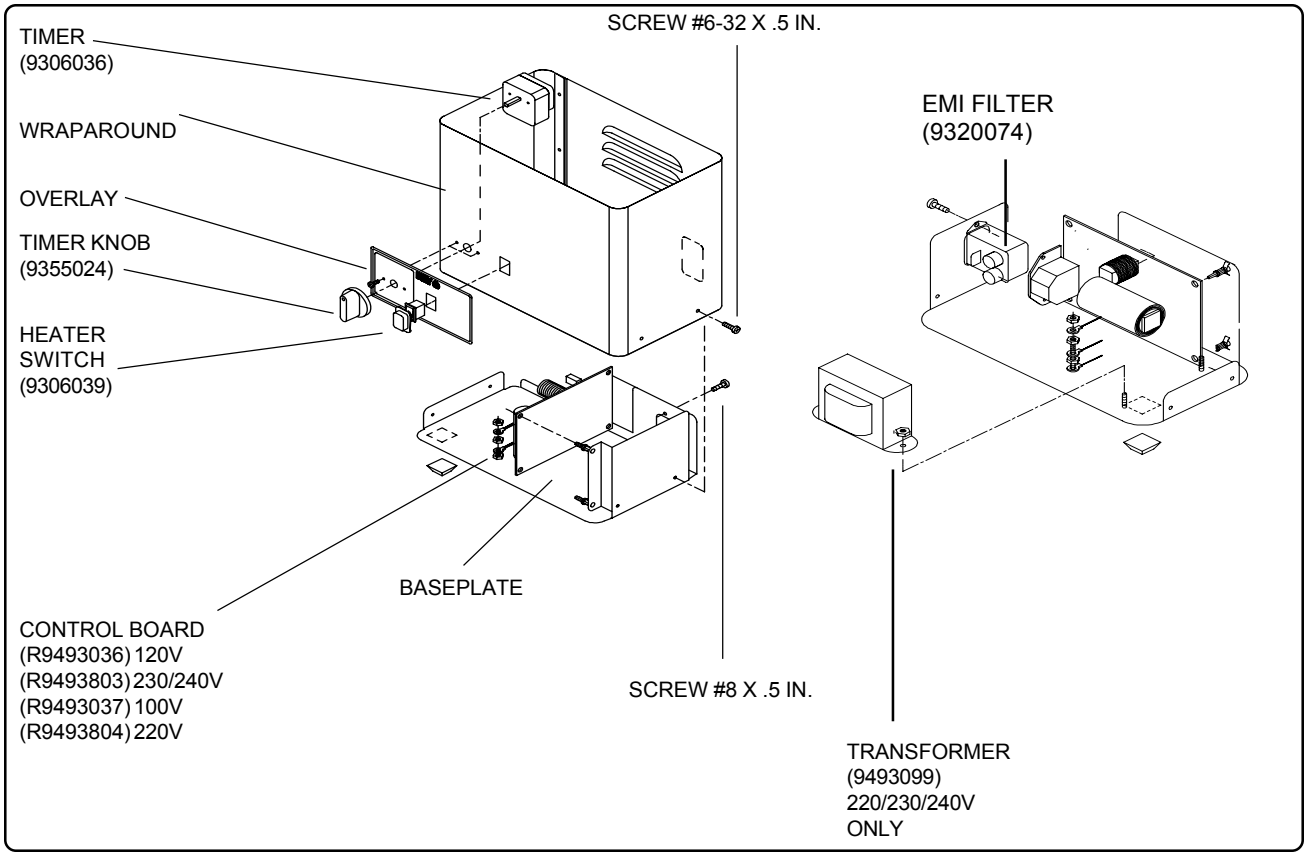
### 4.2.3 MODEL 19 SERVICE PARTS

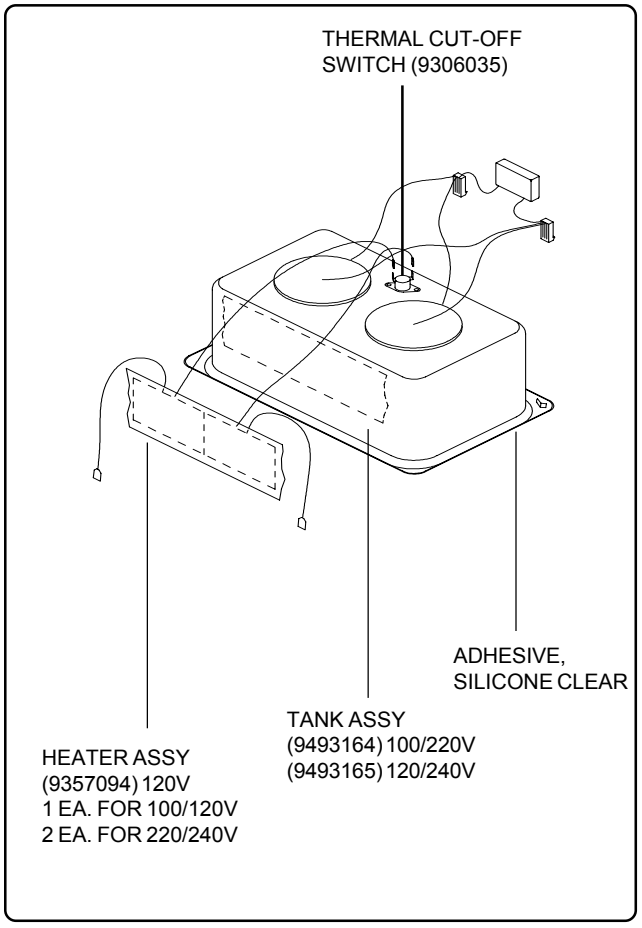


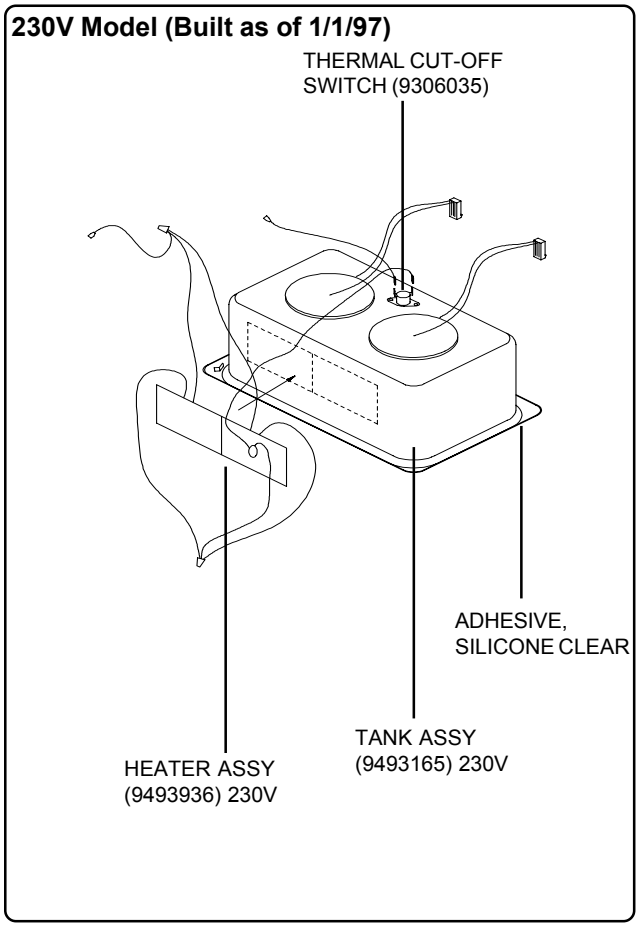



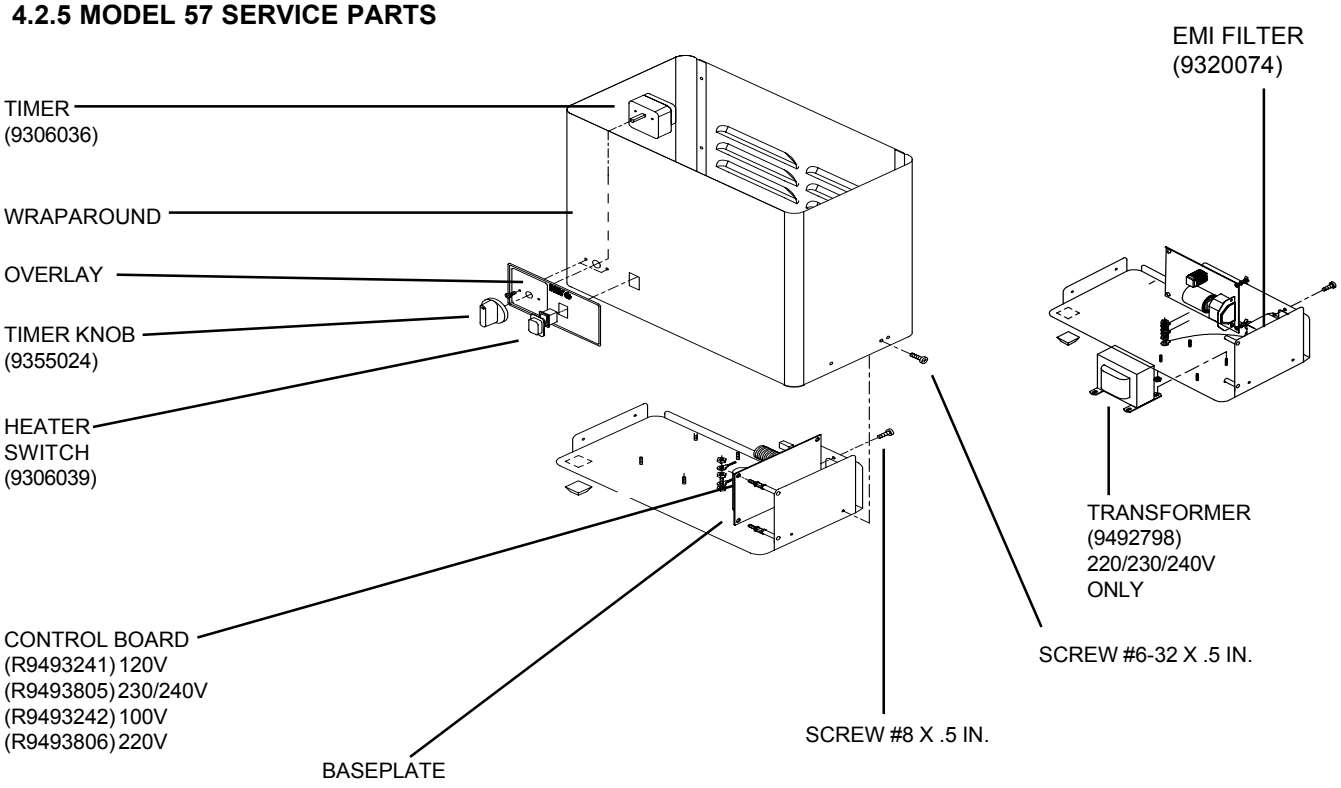
### 4.2.4 MODEL 28 SERVICE PARTS

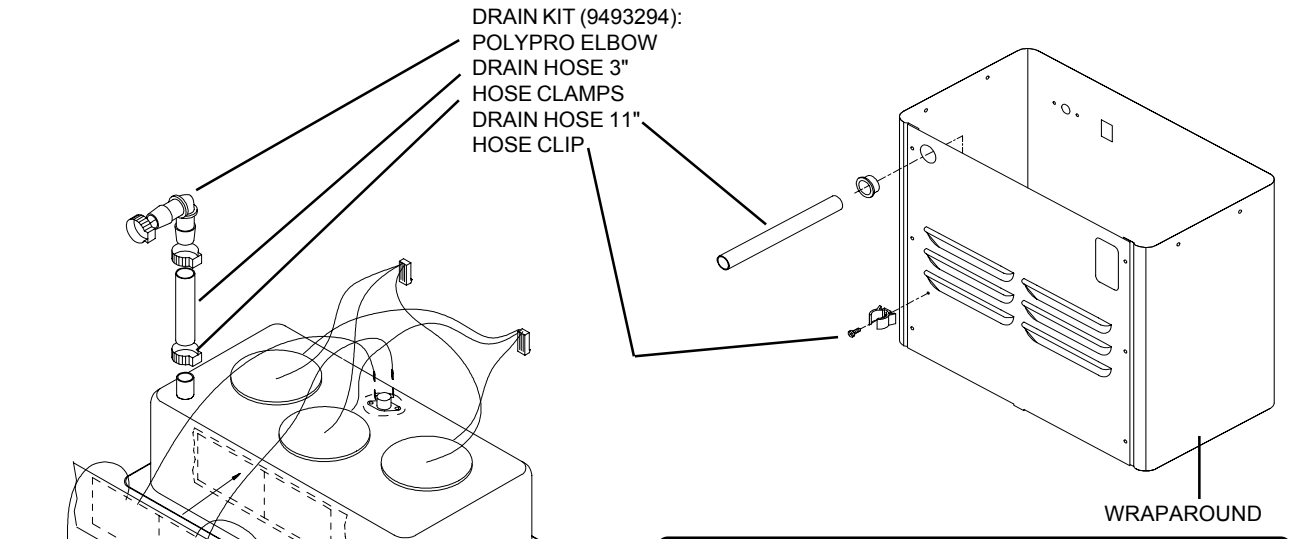


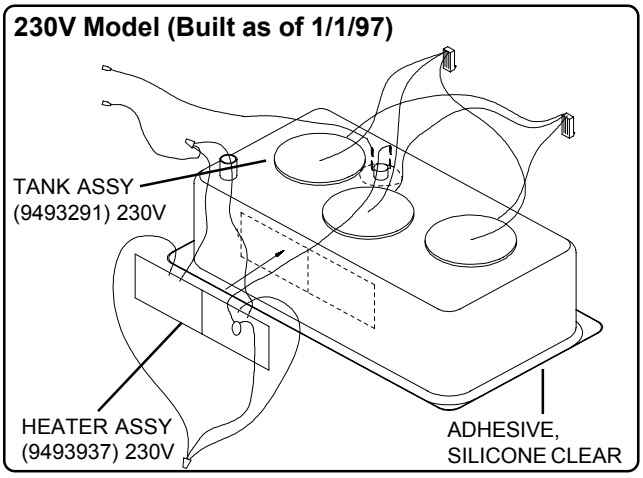



### 4.2.5 MODEL 57 SERVICE PARTS

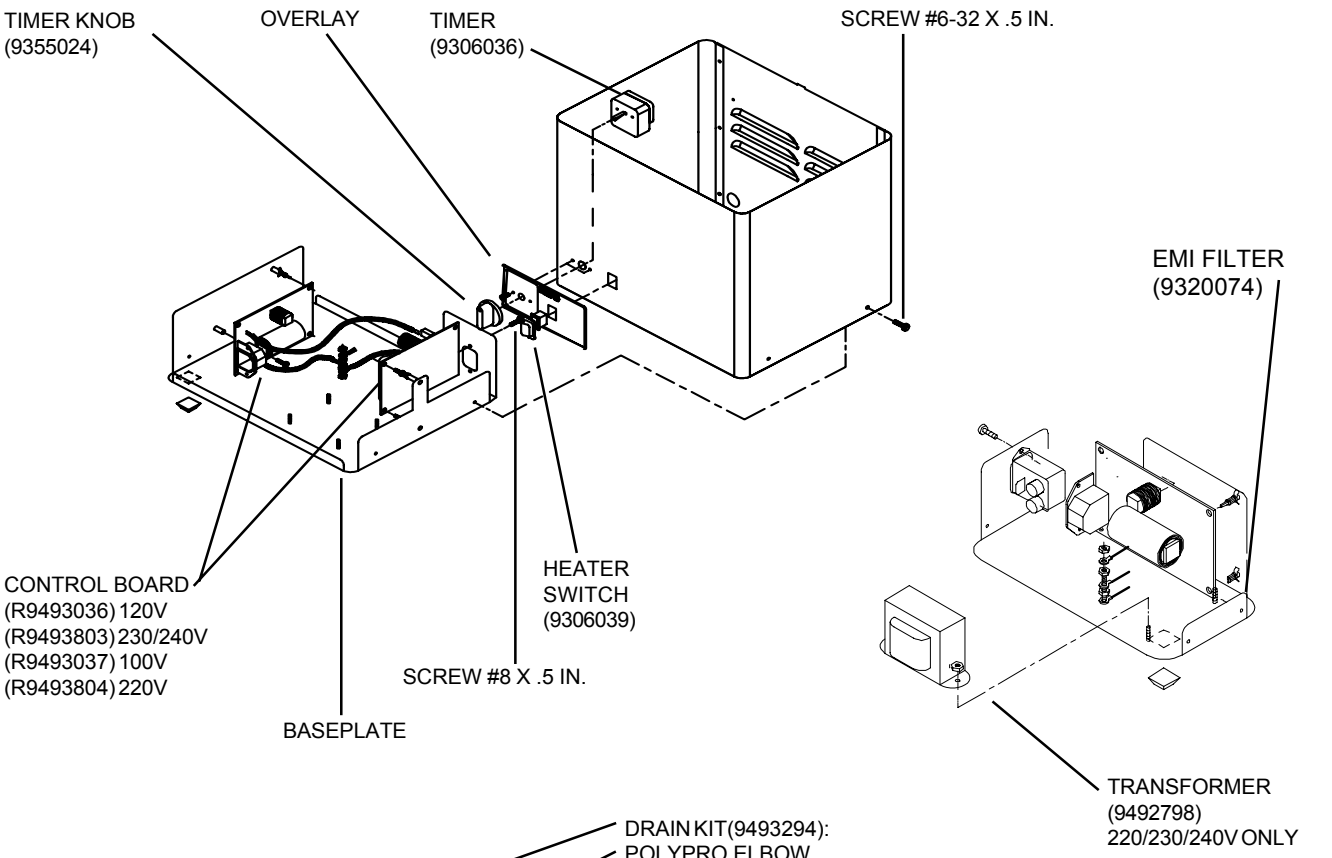


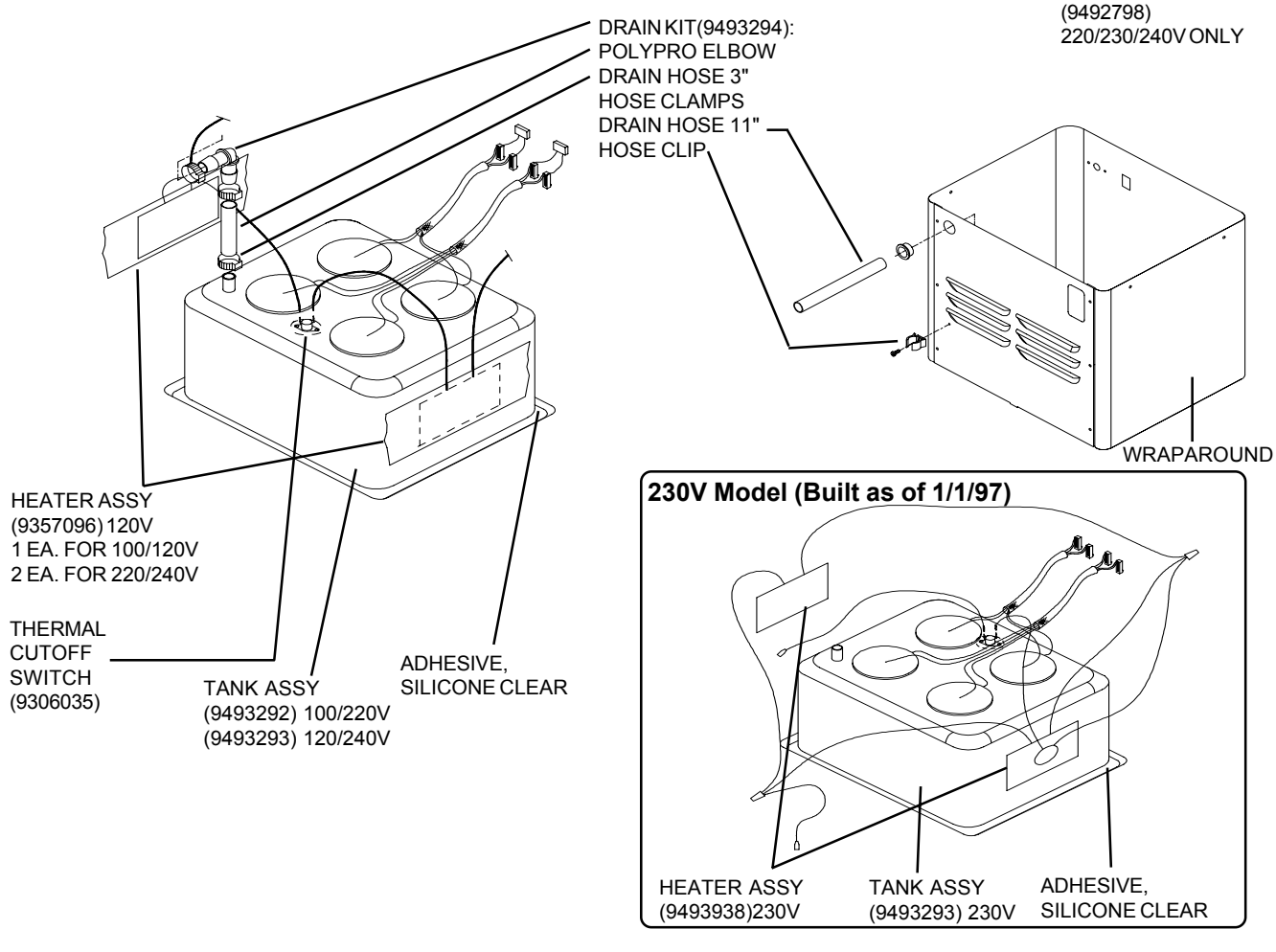




**230V Model (Built as of 1/1/97)**



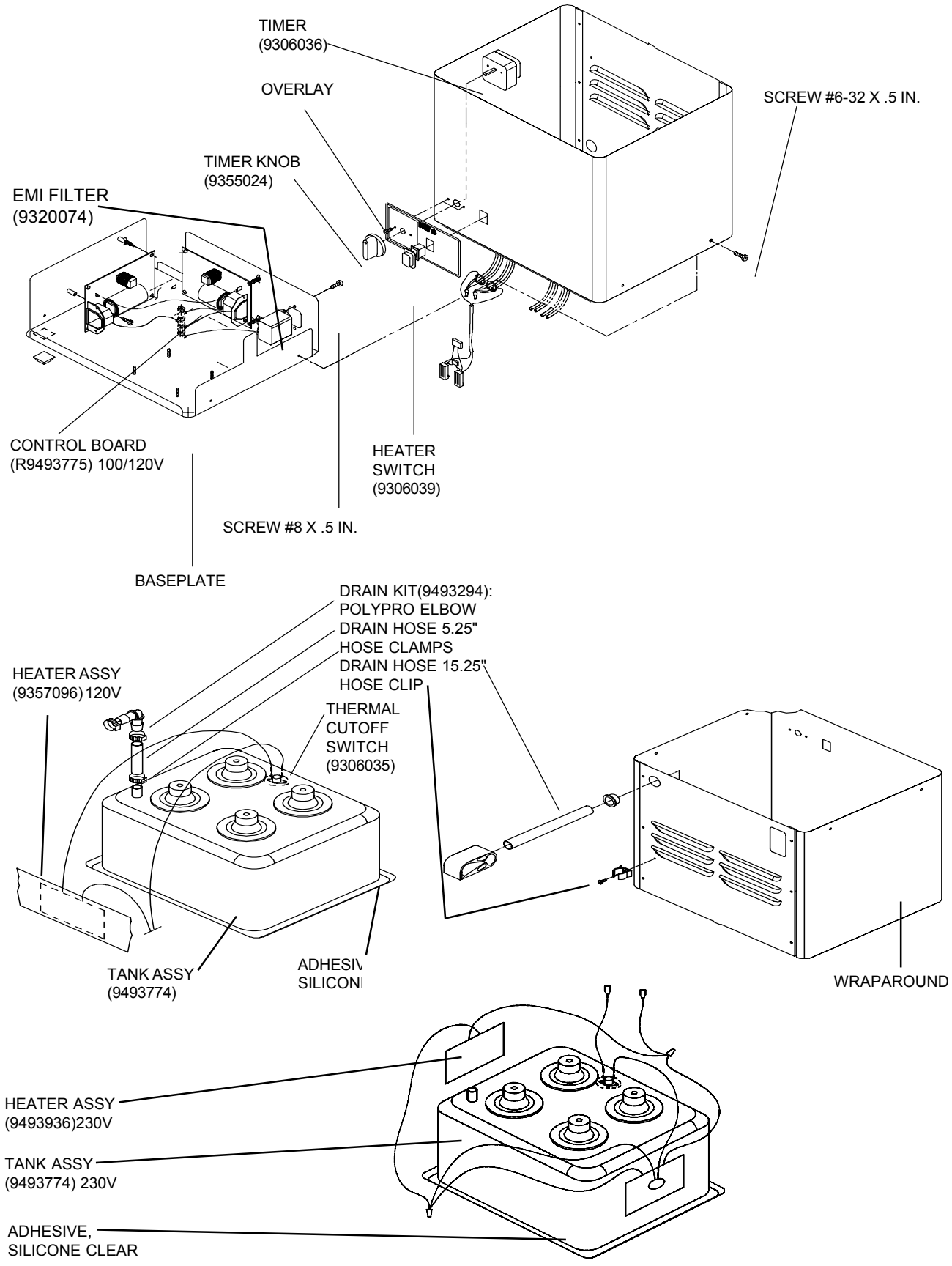
### 4.2.6 MODEL 104 SERVICE PARTS



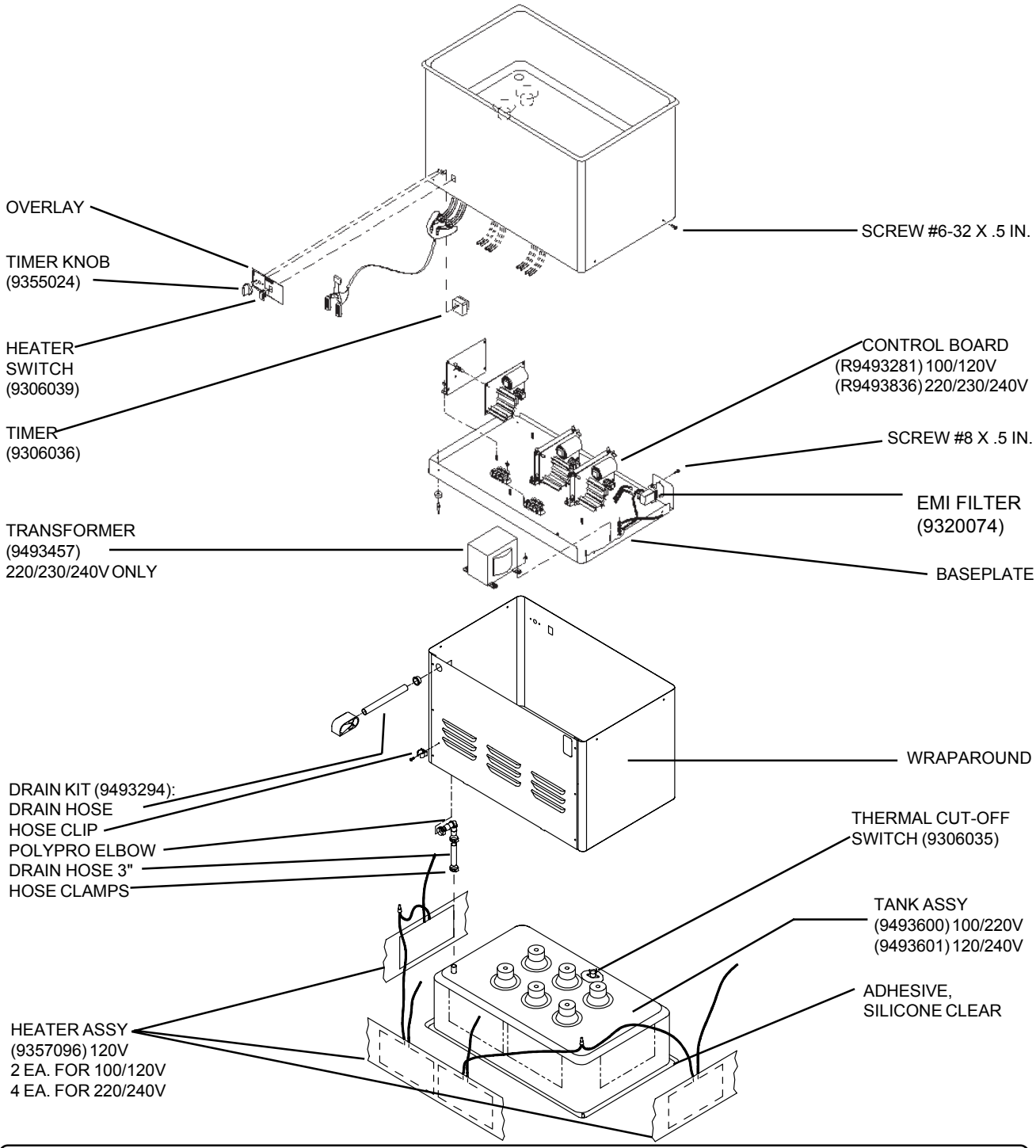




**230V Model (Built as of 1/1/97)**

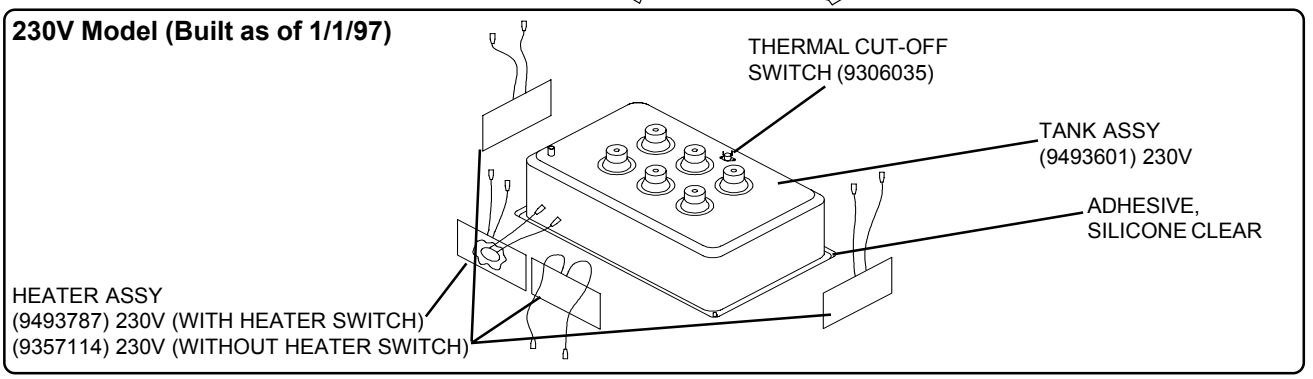
### 4.2.7 MODEL 136 SERVICE PARTS



### 4.2.8 MODEL 208 SERVICE PARTS

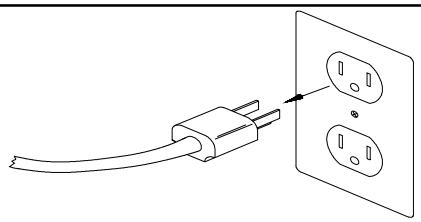



**230V Model (Built as of 1/1/97)**

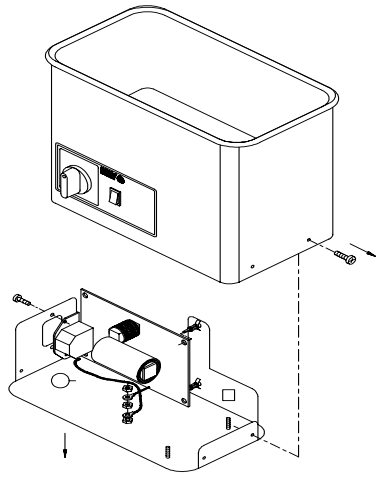


**5.1 PCB REPLACEMENT**
(Model 14 shown)

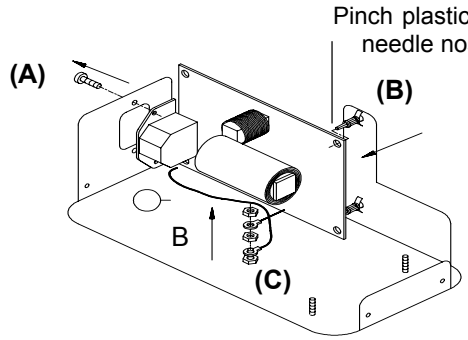
Tools : Phillips #2 screwdriver
needle nose pliers
5/16" nut driver



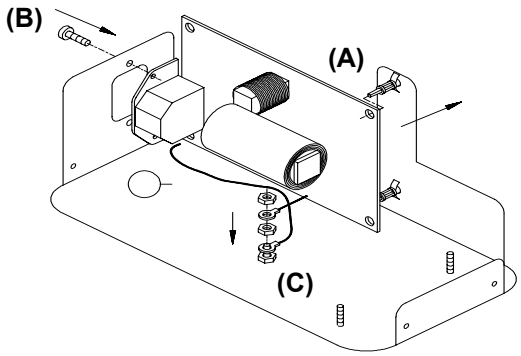
5.1.1 - Disconnect power cord from wall outlet.



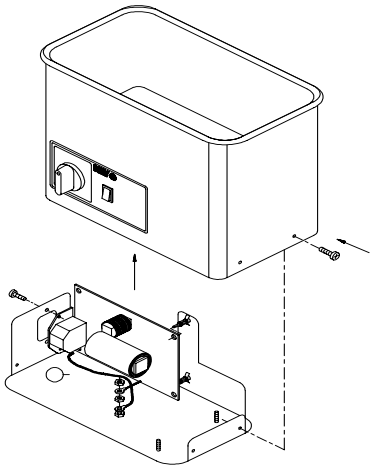
5.1.2 - Remove 4 screws from sides of cleaner.
- Remove base from bottom of wraparound.




5.1.3 - Remove 2 screws **(A)** from base side flange, pinch plastic standoffs **(B)** on rear flange
- Remove grounding nuts **(C)**
- Disconnect piezo disc red and white wire connectors from pcb.
- Disconnect wiring from timer, heater switch and thermostat switch (Model 28 and larger).
- Remove PCB.




5.1.4 - Replace with new PCB.
- Snap PCB onto plastic stand-offs **(A)**.
- Install 2 self tapping screws through base into connector.**(B)**
- Snap PCB onto plastic stand-offs.
- Reconnect connector to timer, heater switch and thermostat switch (mod 28 and larger).
- Reconnect piezo disc red and white wire connectors to pcb.
- Reconnect ground wires **(C)**.



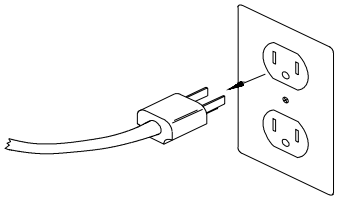
5.1.5 - Reinstall base assembly.
- Install 4 screws through wraparound into base.

5.1.6 - **WARNING:** Do not operate cleaner without installing 4 screws. The bottom of the tank may touch a component on the PC board.

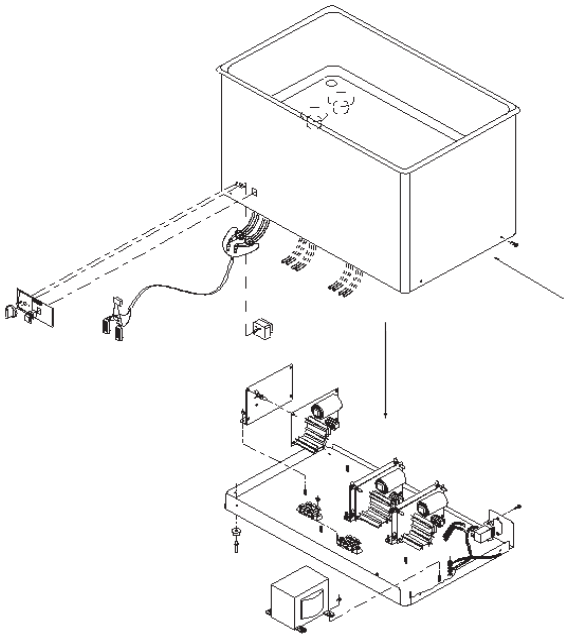
**5.2 PCB REPLACEMENT**

(Model 208 shown)

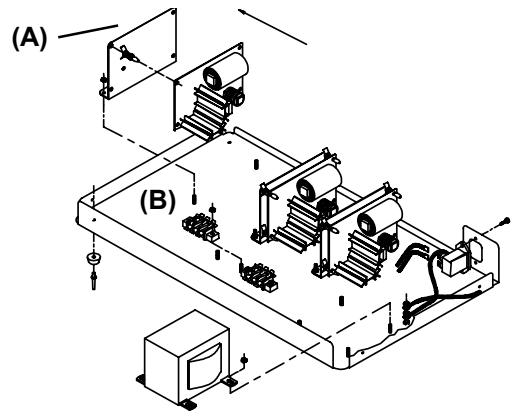
Tools: Phillips #2 screwdriver
needle nose pliers
5/16" nut driver



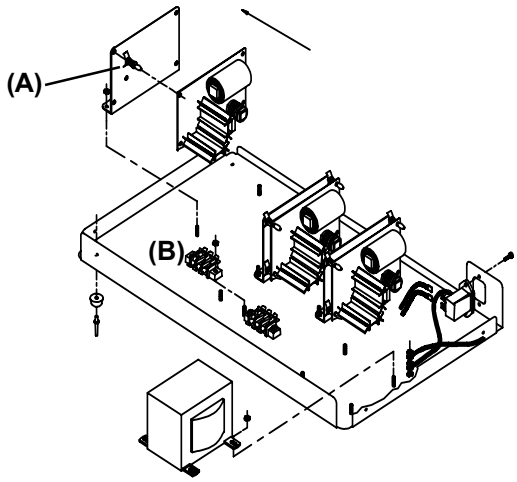
5.2.1 - Disconnect power cord from wall outlet.



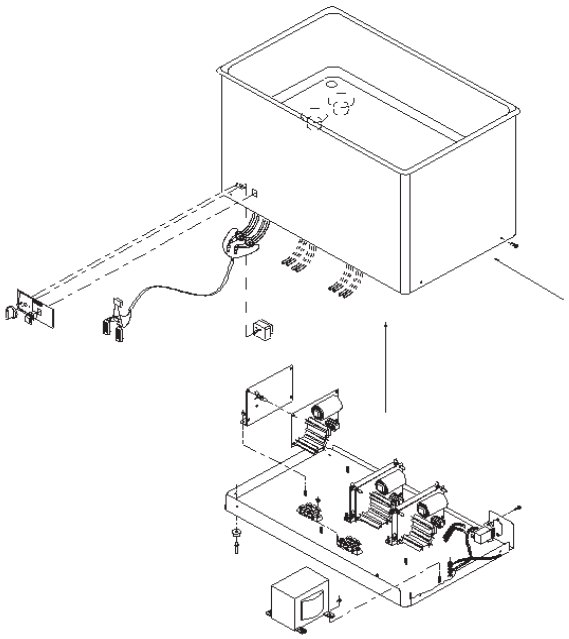
5.2.2 - Remove 4 screws from sides of cleaner.
- Remove base from bottom of wraparound.




5.2.3 - Pinch plastic standoffs **(A)** from PCB bracket
- Disconnect wiring from terminal block **(B).**
- Disconnect piezo disc red and white wire connectors from pcb.
- Remove PCB.




5.2.4 - Snap PCB onto plastic standoffs **(A)** on PCB bracket.
- Reconnect wiring to terminal block **(B).**
- Reconnect piezo disc red and white wire connectors onto pcb.



5.2.5 - Reinstall base assembly.
- Install 4 screws through wraparound into base.

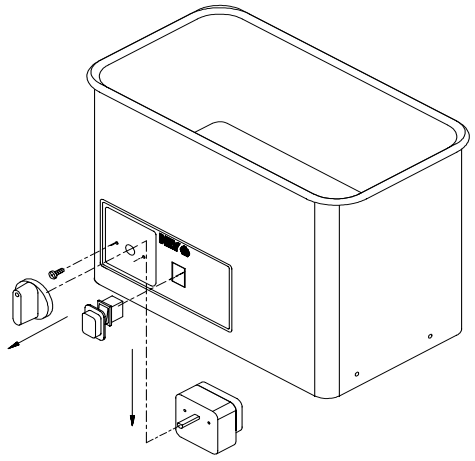
5.2.6 - **WARNING:** Do not operate cleaner without installing 4 screws. The bottom of the tank may touch a component on the PC board.

## 5.3 TIMER REPLACEMENT

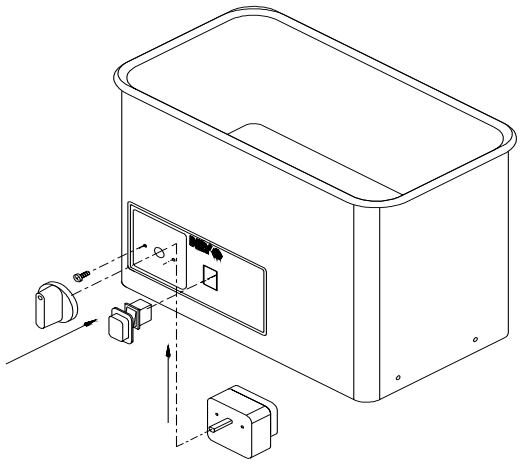
(Model 14 shown)

Tools: Phillips #2 screwdriver
5/16" nut driver

5.3.1 - Follow steps 5.1.1 and 5.1.2 to remove base assembly.



5.3.2 - Remove timer knob by pulling.
- Remove 2 screws from front.
- Disconnect female connectors from timer.
- Remove timer.



5.3.3 - Fasten new timer with 2 screws through wraparound.
- Connect wires to timer terminals.
- Connect timer knob.

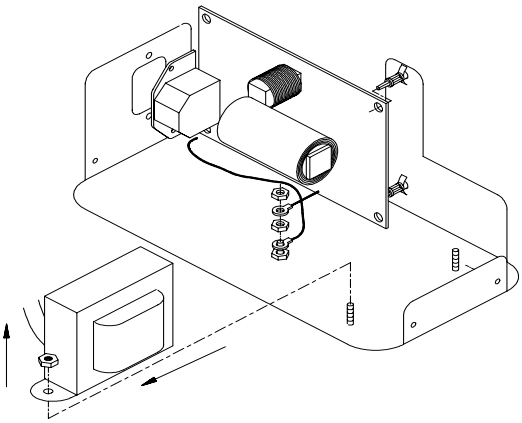
5.3.4 - Repeat section 5.1.5 and 5.1.6

## 5.4 TRANSFORMER REPLACEMENT (220/240V only)

(Model 14 shown)

Tools: Phillips #2 screwdriver
5/16" nut driver

5.4.1 - Follow steps 5.1.1 and 5.1.2 to remove base assembly.



5.4.2 - Remove nuts from studs on base.
- Remove female connectors from pcb.

5.4.3 - Install new transformer.
- Install 2 nuts onto stud. Connect wires to PCB. (See section 2).

5.4.4 - Follow steps in section 5.1.5

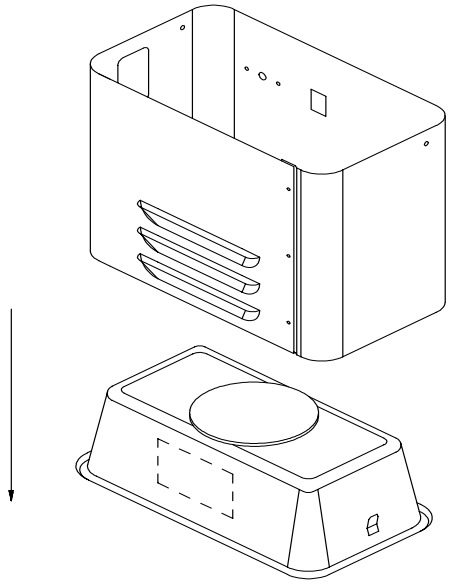
## 5.5 HEATER/TANK REPLACEMENT

(Model 14 shown)

Tools: Phillips #2 Screwdriver
Razor knife
Slot #2 screwdriver

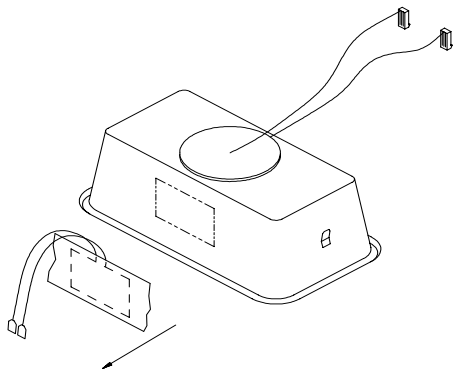
5.5.1 - Disconnect power cord from wall outlet. (5.1.1)

5.5.2 - Remove base from bottom of wrapround (5.1.2)

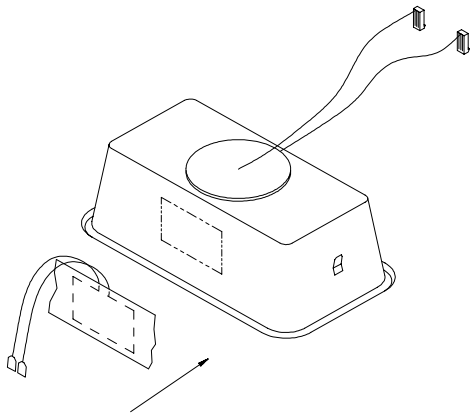


5.5.2 - Turn cleaner upside down. Using a razor knife, remove RTV from rim of tank where it meets tank.
- Then wedge tip of flat screw driver between tank and enclosure.
- Rotate and lift off tank.

Caution: If RTV is not cut through all the way, damage may occur to wraparound or tank.



5.5.4 - Remove 3/16' female terminals from heater switch (Reference wiring diagram, Section 2.8).
- Peel off aluminum tape then heater.



5.5.5 - Clean residue off tank where new heater is to be applied. A clean surface is required for good adhesion and heater reliability.
- Apply new adhesive backed heater along the bottom edge of the tank.
- Apply aluminum tape over heater.

5.5.6 - Reconnect heater wires to switch.
- Follow step 5.1.5 to install base assembly to wraparound.

5.5.7 - Apply RTV to tank rim.
- Place wraparound onto tank/RTV, press tightly.
- Allow RTV to cure overnight before operat ing.

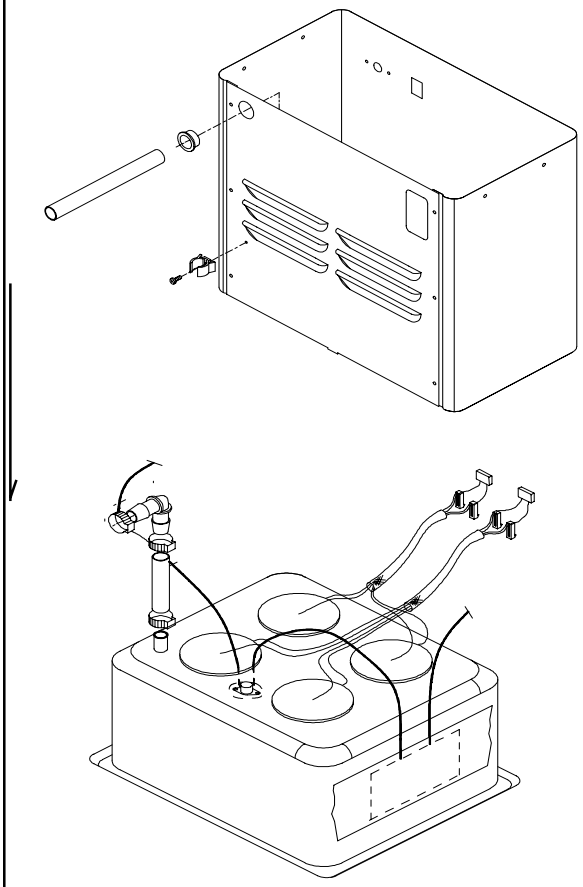
## 5.6 HEATER/TANK REPLACEMENT

(Model 104H shown)

Tools: Phillips #2 Screwdriver
Razor knife
Slot #2 Screwdriver

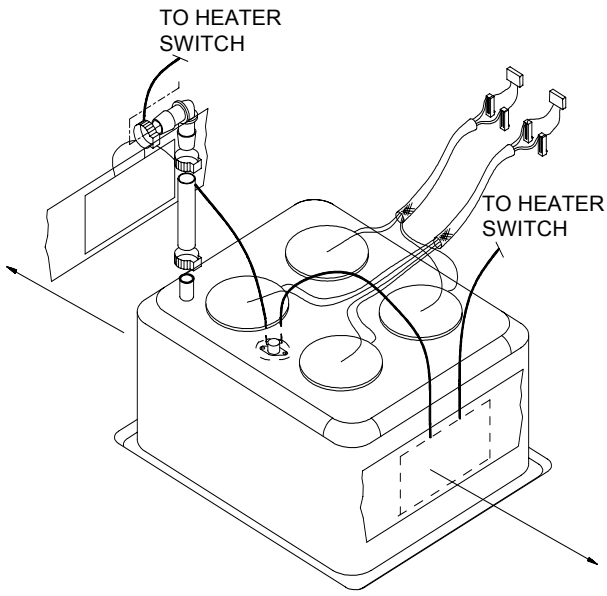
5.6.1 - Disconnect power cord from wall outlet. (5.1.1)

5.6.2 - Remove base from bottom of wraproud (5.1.2)

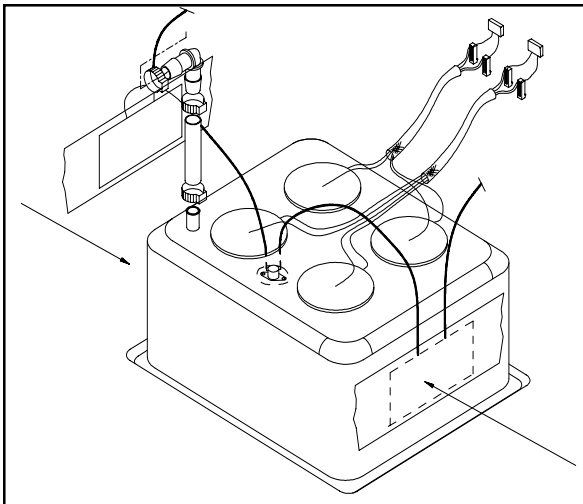


5.6.3 - Turn cleaner upside down. Using a razor knife, remove RTV from rim of tank where it meets tank.
- Then wedge tip of flat screw driver between tank and enclosure.
- Rotate and lift off tank.

Caution: If RTV is not cut through all the way, damage may occur to wraparound or tank.




5.6.4 - Remove female terminals from heater switch and from thermal cut-off switch (Reference wiring diagram, Section 2.8).
- Peel off aluminum tape and heater.



5.6.5 - Clean residue off tank where new heater is to be applied. A clean surface is required for good adhesion and heater reliability.
- Apply new adhesive backed heater along the bottom edge of the tank.
- Apply aluminum tape over heater.

5.6.6 - Reconnect heater wire to switch.
- Repeat step 5.1.5 to install base assembly to wraparound .

5.6.7 - Apply RTV on tank rim.
- Place wraparound onto tank/RTV.
- Allow RTV to cure overnight before operating cleaner.

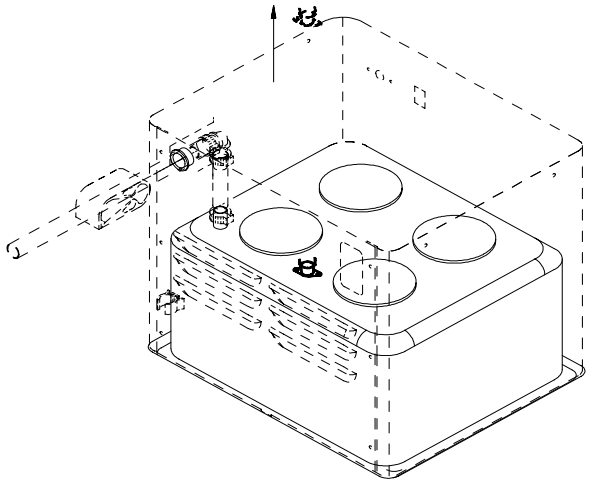
## 5.7 THERMAL CUT-OFF REPLACEMENT

(Model 104H shown)

Tools: Phillips #2 Screwdriver
Razor knife
Slot #2 screwdriver

5.7.1 - Disconnect power cord from wall outlet. (5.1.1)

5.7.2 - Remove base from bottom of wrapround (5.1.2)



5.7.3 - Remove 1/4" female terminals from thermal cut-off switch (Reference wiring diagram, Section 2.8).
- Remove thermal switch using putty knife.

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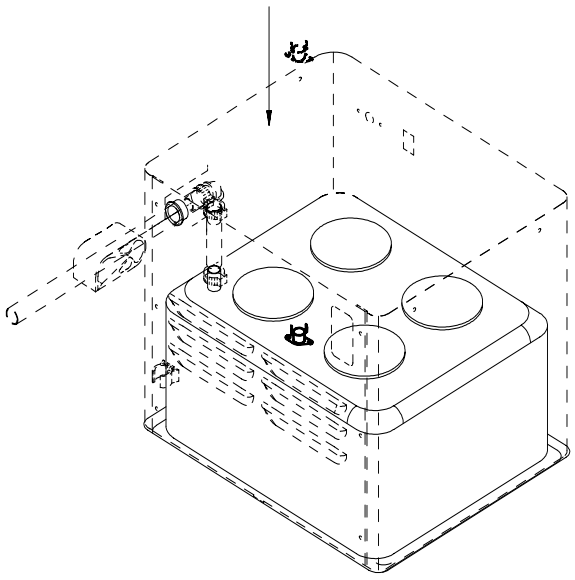

5.7.4 - Clean RTV residue off tank where new thermal cut-off switch is to be applied. A clean surface is required for good adhesion and switch reliability.
- Apply new RTV (1 in diameter).
- Place new thermal cut-off switch in same position as old.
- Allow RTV to cure overnight reconnecting wires to terminals.

5.7.5 - Reconnect wires to switch. (Reference wiring diagram, Section 2.8).
- Repeat step 5.1.5 to install base assembly to wraparound.

# ULTRASONIK SERVICE NOTES: