

# Technicians Service and Repair Manual for Tuttnauer Automatic Autoclaves

Models E, EK, EA, EKA, EZ and EZ10K



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This manual is intended for the qualified technician. The instructions and guidance go into great detail, but basic trouble shooting and diagnostic skills are still required.

I want to thank all the members of the technical staff at Tuttnauer USA with out whose help this manual could not have been completed

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# 1 General Information

## 1.1 The Tuttnauer Company

The Tuttnauer Company founded in 1925 produces infection control equipment for the Dental, Medical, Veterinary and Laboratory markets. In addition, Tuttnauer produces large walk-in units for industrial, commercial and hospital applications. Tuttnauer equipment is distributed worldwide and the Tuttnauer Company is considered a leader in the field of **Infection Control Apparatus**.

Our main product line consists of manually operated and automatic sterilizers. The following list shows past as well as currently available models of Tuttnauer sterilizers.

### Manually operated models:

**M** = Manual  
**MK** = Manual Kwiklave\*

Chamber sizes:           7" x 12";           9" x 18";  
(diameter x depth)   10" x 19";       15" x 30"  
                                  and 15" x 27"

### Automatic models:

**E** = Electronic  
**EA & EZ** = Fully Automatic with Air Assisted Drying  
**EK** = Electronic Kwiklave \*  
**EKA & EZ10k** = Fully Automatic Kwiklave \* with Air Assisted Drying

Chamber sizes:           7" x 12";           9" x 18";  
(Diameter x Depth)   10" x 19";       15" x 30"  
                                  15" x 27"

Tuttnauer offers a wide variety of standard models of autoclaves, as well as custom designed units.

### Additional Tuttnauer products:

- **Chamber Brite** autoclave cleaner
- **Clean & Simple** ultrasonic enzymatic cleaning solution in tablet form
- **Ultrasonic Cleaners** - 1 & 3 gallon
- **Water Distillers** – 1gal, 3.5gal, 8gal and 12gal

\* Kwiklave units have faster cycle times than a standard unit, while maintaining standard sterilization exposure times.



## 1.2 Warranty

Tuttnauer's warranty covers defects in materials and workmanship on every part in the autoclave. For exact details, see a formal copy of the Warranty Policy or call Tuttnauer at 1 800 624 5836.

This warranty covers both parts and labor for new autoclaves only.

Tuttnauer warrantee's chambers (on select models) for a period of ten (10) years against any defects in materials and workmanship. This chamber warranty went into effect January 1997, (for more details call 1 800 624 5836).

These warranties do not apply to any improper installation or application; nor shall it extend to products, which have been altered outside the factory without prior authorization from Tuttnauer; nor to products, which have been improperly maintained.

No product will be received or accepted for repair without proper return authorization from Tuttnauer. All transportation charges to and from Tuttnauer are the responsibility of the owner of the autoclave. During the first 30 days after purchasing a new autoclave, Tuttnauer will pay shipping costs on an individually evaluated basis and **ONLY** with pre-approval.

This warranty will be void if the unit is not purchased from an authorized Tuttnauer dealer.

To activate the warranty, the registration card must be completed and returned to Tuttnauer within fourteen (14) days of purchase or you may call Customer Service at 1 800 624 5836.

Tuttnauer's obligation is limited to repair or replacement of parts for the autoclave.

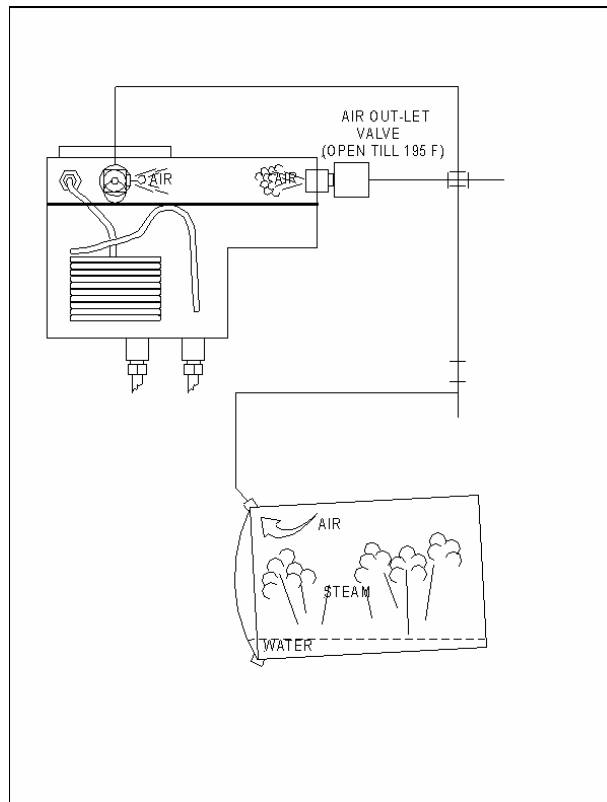
No other warranties or obligations are expressed or implied.

### 1.3 Theory of Operation

#### Theory of Operation – Electronic Steam Sterilizer Models E, EK, EA, EKA, EZ and EZ10k

The Tuttnauer Steam Sterilizer is designed as a gravity displacement system. This means that no other methods are used to move steam and air in or out of the Chamber other than the natural forces of gravity.

Water inside the autoclave Chamber is heated to produce steam. The rising steam forces any air inside the Chamber to the top of the Chamber where it is bleed off by the Air Jet. This event is due solely to the effect of gravity on the steam and air. As the pressure builds within the Chamber, the air is continuously expelled through the unit's Air Jet. The Air Jet is located in the water reservoir and connected by a copper tube to the top rear of the Chamber. The process of removing the air and leaving only steam in the Chamber is essential to the operation of the Sterilizer. Assisting the Air Jet in this function is the Air Outlet Valve. This valve participates in removing the air until a temperature of 195° is reached then the valve closes and any remaining air is removed by the Air Jet.



Steam temperature has a direct and important correlation to steam pressure. At every level of pressure, steam has a specific corresponding temperature; this is a universally accepted fact. There is one stipulation required to make this true, there must be 100% steam present. For this reason, it is important that the air be removed as completely as possible from the Chamber. Removing the air is what allows the temperature to rise properly inside the Chamber.

The importance of a clean working Air Jet cannot be understated. The Air Jet has two important functions:

- First is to remove the air from inside the Chamber while the unit is heating up. If air were allowed to remain in the Chamber its presence would produce pockets of low and high temperatures. These uneven temperatures within the Chamber would result in areas of no sterilization. Only by removing the air can more uniform temperatures be attained and as a result, even and complete sterilization.
- The Air Jet has a second function, which is to maintain circulation within the Chamber. It does this by remaining open after all the air has been bled off and continuing to purge the steam. This constant purging of steam causes motion within the Chamber. This constantly moving, constantly circulating steam is important in maintaining uniform temperature. Uneven steam temperatures can be the result of the heating elements turning on and off during the sterile cycle. This can cause hot and cold pockets of steam within the Chamber. If an instrument is in one of these cold pockets, it will not be sterilized even though the rest of the load was and the spore test confirmed a sterile load. The end result of keeping the steam in motion, because of the Air Jet, is that no pockets of uneven temperature will form and the load will be completely sterilized.

Why use steam in the first place?

There are several reasons for preferring a steam Sterilizer.

- ◆ The first is that steam is non-toxic.
- ◆ The second is that steam sterilization is fast. Steam has excellent heat transfer properties.  
Steam allows for tremendous amounts of heat energy to be transferred to the instruments instantaneously. This flash of energy is what destroys the biological contamination.
- ◆ Third, steam is readily available and easy to make from any water source.
- ◆ Fourth, equipment designed for steam sterilization is simpler to manufacture and use.

Basic operation of the autoclave.

1. The operator closes the door and presses start.
2. Water flows into the Chamber; the Air Outlet Valve is open so that the water can flow in smoothly. Water flowing into a hot sealed Chamber will build pressure immediately, exerting a force on the water that can slow or even stop it from entering the Chamber. The open Air Outlet Valve provides an escape for that pressure, releasing that pressure allows the water to flow easily.
3. The autoclave heats to the proper temperature, controlled by the temperature and pressure sensor. The Air Outlet Valve closes at 195°F. Air escapes the Chamber through the Air Jet.
4. Once the temperature is reached, the timer counts down the programmed amount of sterilization time. Steam continues to purge through the Air Jet eliminating any differences of temperature that can occur within the Chamber.
5. The autoclave exhausts and the sterilization is complete.

## **2 Installation and Setup**

### **2.1 Unpacking and Inspection**

Upon receiving the autoclave, carefully inspect the outside of the shipping carton for any signs of damage. If any damage to the shipping carton is found, note the location with respect to the autoclave and check that area of the autoclave carefully once it is fully unpacked. In addition, once the autoclave is fully unpacked, carefully check for any signs of physical damage such as; scratched panels, broken knobs, broken door covers, etc...

If any damage is found, contact the dealer as soon as possible so that they can file a claim with the shipping carrier and also notify Tuttnauer.

All Tuttnauer products are carefully inspected prior to shipment and all reasonable precautions are taken, in preparing them for shipment, to assure safe arrival at their destination.

**Note:** Lifting and carrying should always be done by two people

### **2.2 Unit Location**

The unit should be located on a stable, solid countertop. In the case of the 3850 and 3870 models a table is provided with the unit.

It is not recommended that units be stacked. Adequate clearance is required above the autoclave for the purpose of filling the reservoir with distilled water. In addition, some steam escapes through the filling hole. If overhead cabinets are too close, steam damage can occur to the underside of the cabinets.

A minimum of one inch clearance is required on each side and at the back of the autoclave for access and ventilation.

**Note:** Lifting and carrying should always be done by two people

## 2.3 Voltage Requirements

**All 110 volt units need to have a stable voltage between 110 and 125 volts AC.**

**All 220 volt units need to have a stable voltage between 220 and 235 volts AC.** For EK, EKA and EZ10k units, check that the incoming voltage is between 220 volts and 235 volts AC. This is important because too high a voltage will damage the heating elements and too low a voltage will cause the sterilizer to run slower. In either case, a Buck/Boost Transformer is recommended to correct the voltage. A Buck/Boost Transformer is relatively inexpensive and can be configured to either raise or lower the voltage.

**It is recommended that all autoclaves be installed on a direct line.**

**The use of a surge suppressor is recommended, especially in areas where there is a large fluctuation in voltage or frequent lightning strikes.**

## 2.4 Setup

There are two procedures for setup depending on if the autoclave has a Water Pump or not.

### 2.4.1 Setup and Automatic Filling for Units Without Water Pumps

These units will have Microprocessors with Software version numbers that do not contain the letters **WP** [see sec. 8.12].

In these units the Chamber is filled from the Reservoir by gravity flow.

#### **Adjusting the Chamber Pitch**

Proper adjustment of the Chamber pitch and Automatic Fill are among the most important things you can do for the sterilizer. Proper Chamber pitch and Automatic Filling insures that the sterilizer will have the proper amount of water in the Chamber at the beginning of each cycle. Insufficient water in the Chamber, at the beginning of the cycle, will generate a LOW WATER message at some point during the cycle, when the water level becomes too low. If, on the other hand, there is too much water in the Chamber, this will extend the heating portion of the cycle. In cases where the heating portion of the cycle is extended for more than 50 minutes (or 80 minutes for a 3850 / 3870) the sterilizer will abort that cycle.

- ◆ Start with a sturdy, level counter.
- ◆ Make sure all the feet are on the autoclave and none have been lost.
- ◆ Make sure the front feet are free to move in and out.
- ◆ Position the autoclave on the counter.
- ◆ Fill the Reservoir with distilled water [see sec. 5.2].

- ◆ The Chamber should be empty of any instruments, trays or leftover water.
- ◆ The autoclave should be turned off.
- ◆ The Chamber pitch now needs to be adjusted correctly.
- ◆ Measure out the proper amount of distilled water for the appropriate model unit as listed below:

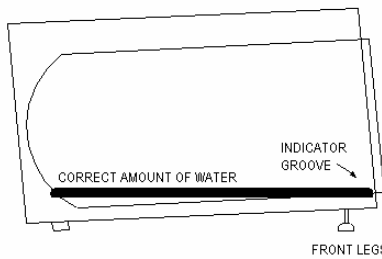
1730 = 10 oz. (300ml)  
 2340 = 14 oz. (400ml)  
 2540 = 14 oz. (400ml)  
 3140 (3545) = 17 oz. (500ml)  
 3850 = 24 oz. (700ml)  
 3870 = 29 oz. (850ml)

**All water volumes can be +2 oz and – 0 oz**

- ◆ Pour the proper amount of water into the Chamber through the front door of the unit.
- ◆ The water should cover the bottom of the Chamber to within +/- 1/2 inch of the groove in the front.
- ◆ If necessary, adjust the front Leveling Feet so that the water lies in the Chamber correctly.
- ◆ Once the Chamber pitch adjustment is completed, empty the water from the Chamber and check if the automatic filling is set correctly.

**PLEASE BE ADVISED**  
**WHEN REINSTALLING YOUR**  
**AUTOCLAVE THE FOLLOWING**  
**MUST BE CHECKED**

**CHAMBER PITCH ADJUSTMENTS:**  
 Pour the correct amount of water into the chamber, the water should be within +/- 1/2 inch of the indicator groove at the front of the chamber. If not, adjust the front legs to accommodate.



**DISTILLED WATER**

MODEL	AMOUNT
1730	10 oz (300ml)
2340	14 oz (400ml)
2540	14 oz (400ml)
3140	17 oz (500ml)
3850	24 oz (700ml)
3870	29 oz (850ml)

THESE WATER VOLUMES CAN VARY BY +2oz AND -0oz

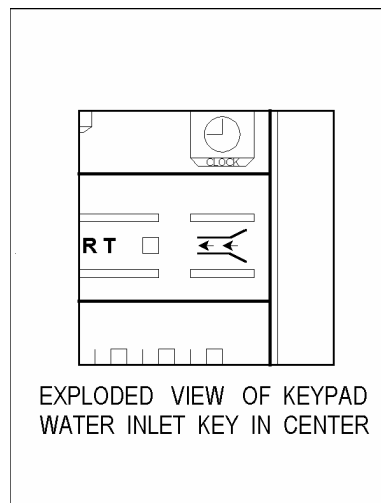
## Checking the Automatic Fill

To check the automatic filling procedure, follow the next few steps:

- ◆ Remove any water that is in the Chamber.
- ◆ Make sure the unit is turned on.
- ◆ With the Door open, press and hold the Door Switch.
- ◆ Press the **START Key**.
- ◆ When water starts flowing into the Chamber, release the Door Switch.
- ◆ Water should come up to the same spot as the measured amount had.
- ◆ If the water fill is not working correctly, try the adjustment procedure or check for a system problem [see sec. 7.15].

## Automatic Filling Adjustment Procedure

- ◆ Make sure the power is off.
- ◆ The Door should be open.
- ◆ Press and hold the **Water Inlet Key** (this is the button on the front Keypad with the two arrows).
- ◆ Turn the power on.
- ◆ When the normal display screen appears, release the **Water Inlet Key** – wait one second and then press it in again.
- ◆ Water should begin flowing into the Chamber.
- ◆ Monitor the water flow into the Chamber.
- ◆ Hold the **Water Inlet Key** until water reaches the groove at the front.
- ◆ Release the button – wait ten seconds – the unit is now reprogrammed and ready to use.



## 2.4.2 Setup and Automatic Filling for Units With Water Pumps

Any unit with a Microprocessor Software version number ending in **WP** [see sec. 8.12] will have a Water Pump installed to insure proper filling.

- ◆ Start with a sturdy, level counter.
- ◆ Make sure all the feet are on the autoclave and none have been lost.
- ◆ Make sure the front feet are free to move in and out.
- ◆ Position the autoclave on the counter.
- ◆ Fill the Reservoir with distilled water [see sec. 5.2].
- ◆ The Chamber should be empty of any instruments, trays or leftover water.
- ◆ The unit is now ready to use.

To calibrate the automatic fill follow this procedure:

1. Press the **STOP Key** repeatedly until the message “Code: xxx” appears.
2. Using the **UP/DN** arrow keys change the code to 105 and press the **STOP Key**.
3. A message will be displayed saying “Water in = xx sec.”
4. Using the **UP/DN** arrow keys, change the seconds according to the following table:

2340/EZ9	= 30 sec
2540/EZ10/EZ10K	= 35 sec
3140	= 40 sec
3850	= 45 sec
3870	= 65 sec

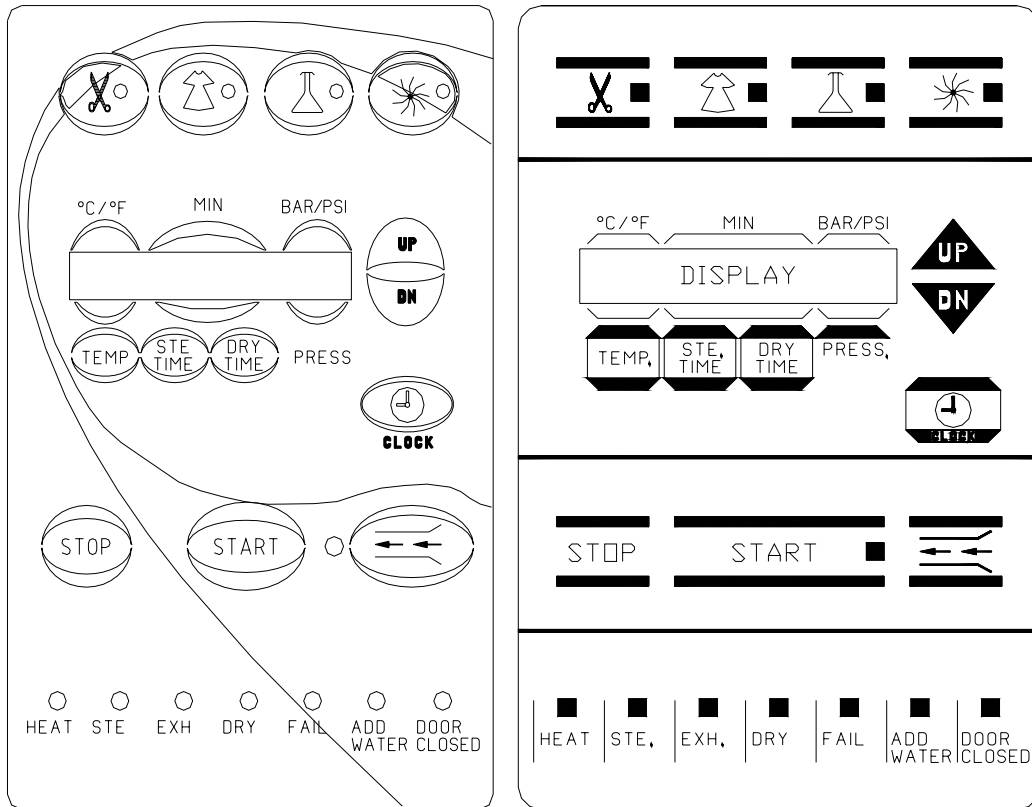
5. Press the **STOP Key**.
6. On some units the message “Ea Type:” may appear, using the **UP/DN** arrow keys select either “0” for an E or EK type unit or “1” for an EA or EKA type unit.
7. Press the **STOP Key** to finish.



### 3 Front Panel Keypad

#### 3.1 Front Panel Keypad

The Front Keypad is divided into four sections, top, upper middle, lower middle and bottom. There are two keyboard types (see below):



**New Type (blue)**

**Old Type (gray)**

The **Top Section** has four lighted buttons; these represent the four available programs. Each program comes preset from the factory with default parameters. Each program can, however, be modified by the operator. If necessary, the default or modified parameters can be locked-in [see sec. 8.10]. When a program is selected, the light in that button will illuminate and the program parameters will appear in the display.

**Moving from left to right the programs are:**

**Unwrapped Instruments** – symbolized by a pair of scissors

The default parameters are:

273°F for temperature  
3 minutes of sterilization time  
Rapid exhaust  
No drying time

**Wrapped Instruments** – symbolized by a gown

The default parameters are:

273°F for temperature  
7 minutes of sterilization time  
Rapid exhaust  
30 minutes of drying time

**Liquids/Glassware** – symbolized by a flask

The default parameters are:

250 °F for temperature  
30 minutes of sterilization time  
Slow exhaust only  
No dry time, drying is not allowed

**Extra Drying Cycle** – symbolized by the fan

The default parameter is:

30 minutes of drying time

The purpose of the **Extra Drying Cycle** is to offer an alternative in situations where the dry time in the wrapped or unwrapped cycle is insufficient. Rather than wait for the items to air dry or run another complete cycle with a longer dry time, just select the **Extra Drying Cycle** to continue the heat assisted drying process.

The *Upper Middle Section* consists of a:

**Display** –

**The Display** is comprised of a single row of 16 characters and this row is divided into four sections.

- ◆ When the system is running a program, the screen will display the current temperature and pressure within the Chamber and the remaining time for sterilization or drying.
- ◆ The first three sections from left to right are designed to show the parameters of the selected program or any operating messages.
- ◆ When the system is idle, the display will show the parameters of the currently selected program.
- ◆ When the system is running a program, the actual sterilization temperature is displayed above the **TEMP Key**. The remaining sterilization time will be displayed above the **STE TIME** key and the remaining drying time will be displayed above the **DRY TIME Key**.

- ◆ If the program aborts as a result of a program check or manual stop, a message will be displayed on the screen. When a message is displayed, pressing any key will erase the message and redisplay the selected program.
- ◆ The last section of the screen, on the right, will continually display the actual current real pressure inside the Chamber and this occurs whether a program is running or not (provided the main power is on).

#### **TEMP Key –**

The **TEMP Key** is used to change the temperature parameter of the **Wrapped, Unwrapped** or **Liquids/Glassware** programs. This can only be done while the autoclave is not running a cycle. Press the **TEMP Key** and a cursor will appear under the temperature parameter. Use the **Up/Down Arrow Keys** to change to the desired temperature. After a few seconds of inactivity the cursor will disappear and the parameter will be locked in. The acceptable range for proper sterilization of wrapped and unwrapped items is between 250°F and 274°F (121°C and 134°C). For liquids the maximum temperature is 250°F (121°C).

In addition, the **TEMP Key** can be used to change the temperature display from Fahrenheit to Centigrade. This can be accomplished by simply turning the power off, pressing and holding the **TEMP Key** and turning the power back on.

#### **STE TIME –**

The **STE TIME Key** is used to change the sterilization time parameter of the **Wrapped, Unwrapped** or **Liquids/Glassware** programs. This can only be done while the autoclave is not running a cycle. Press the **STE TIME Key** and a cursor will appear under the sterilization time parameter. Use the **Up/Down Arrow Keys** to change to the desired sterilization time. After a few seconds of inactivity the cursor will disappear and the parameter will be locked in.

#### **DRY TIME –**

The **DRY TIME Key** is used to change the dry time parameter of the **Wrapped, Unwrapped** and **Extra Drying** programs. This can only be done while the autoclave is not running a cycle. Press the **DRY TIME Key** and a cursor will appear under the dry time parameter. Use the **Up/Down Arrow Keys** to change to the desired dry time. After a few seconds of inactivity the cursor will disappear and the parameter will be locked in. The acceptable range for drying time is 0 to 99 minutes.

In addition, the **DRY TIME Key** can be used to change the pressure display from psi to bar (on all machines up to and including Microprocessors dated T93N6) or from psi to kpa (on all machines with Microprocessors dated T96DN1 or T97DN6 or later). This can be accomplished by simply turning the power off, pressing and holding the **DRY TIME Key** and turning the power back on.

### **CLOCK Key –**

Pressing the **CLOCK Key** once will display the current date with a cursor under the day parameter. Pressing the **Up/Down Arrow Keys** will change the day parameter. Pressing the **CLOCK Key** once again will move the cursor underneath the month and the year parameters. Once the date has been updated, pressing the **CLOCK Key** again will display the time with the cursor under the hour. Use the **Up/Down Arrow Keys** as before to change the hours, run through the minutes and seconds pressing the **CLOCK Key** each time to make the advance. After a few seconds of inactivity the cursor will disappear and the parameters will be locked in.

### **UP / DOWN Arrow Keys**

Pressing these keys will raise or lower the values on any of the parameters that are user adjustable.

The *Lower Middle Section* consists of a:

### **STOP Key –**

This is the only key recognized by the system while a cycle is running. Pressing the **STOP Key** for over one second will cause the current program to abort and the **MAN STOP** message to be displayed.

In addition, the **STOP Key** can be used to reset all the parameters back to their factory defaults. This includes the **Automatic Fill**, in which case it will be necessary to recalibrate the **Automatic Fill**.

- ◆ Turn the power off
- ◆ Press and hold the **STOP Key**
- ◆ Turn the power on

### **START Key –**

Pressing this key will start whichever program cycle has been selected and cause the **START Key** light to turn on.

### **Water Inlet Key–**

This key is symbolized by the two horizontal arrows pointing in through a channel. Pressing and holding this key allows for the manual filling of the Chamber with water. This is useful for calibrating the Automatic Fill, also during cleaning to flush out the Chamber and in case it becomes necessary to bypass the Automatic Fill before running a cycle. Water will flow into the Chamber only as long as the key is depressed.

The **Bottom Section** consists only of indicator lights. Looking from left to right they are the:

**HEAT Light –**

A steady illumination is given when the autoclave is heating up at the beginning of the cycle.

Also, this light will flash during the preheat/standby mode on units in which that option has been activated (all EK, EKA, EZ10K, 3850 and 3870 machines).

**STE Light –**

A steady illumination is given while the autoclave is in the sterilization portion of the cycle.

**EXH Light –**

A steady illumination is given when the autoclave is exhausting the Chamber.

**DRY Light –**

A steady illumination is given while the autoclave is in the Drying mode.

**CYCLE FAIL Light –**

Will illuminate anytime the autoclave detects a problem that results in an aborted cycle.

**ADD WATER Light –**

This indicator will light when the Reservoir is low on water. If the indicator lights, after the **Start Key** has been pressed, the system will continue with the cycle. There is sufficient water in the reservoir to complete this cycle. The next cycle will not be allowed to begin until sufficient water is in the reservoir.

**DOOR CLOSED Light –**

This indicator lights to signal that the Door of the autoclave has been closed.

## 4 Display Messages

### 4.1 Display Messages

Anytime a cycle is aborted, the Tuttnauer autoclave will give an error message. These messages are in the form of words that describe the problem the unit has encountered.

The following is a list of those Error Messages with descriptions of what they mean and indications where the problem may be:

**LOW WATER** This message will be displayed, if during a normal Heat Up stage, the system determines that there is insufficient water **in the Chamber** to complete the cycle. This determination is made by the combined input of two sensors, the Water Electrode and the Temperature Safety Thermostat. Also, if a power failure occurs during the Heat or Sterilization stage after the power returns, the system will check the Water Electrode to see if there is sufficient water **in the Chamber** in order to resume the cycle. If not, the cycle will be aborted, the message **LOW WATER** will be displayed, and the Cycle Fail indicator will light.

Possible causes for this message are:

- a. Insufficient water entered the Chamber at the beginning of the cycle.  
Check for proper leveling, a dirty or shorted Water Sensing Electrode, a clogged Water Pump, a partially clogged line or that the Air Outlet Valve is stuck closed.
- b. A leaky Solenoid Valve, Safety Valve, Air Jet, Door Gasket, Door Bellows or a pipe fitting is allowing water or steam to escape at a higher than normal rate.
- c. A power down has occurred and on power up, if the water Electrode tip is dry the **Low Water** message will be displayed.

**LOW HEAT** This message is displayed, the Cycle Fail indicator lights and the cycle is aborted, if the autoclave has not reached sterilization temperature after heating for 50 minutes in either **Wrapped** or **Unwrapped** programs (80 minutes in the **Liquid** program). Low Heat refers to the temperature in the Chamber before sterilization has begun.

Possible causes for this message are:

- a. No power to the Heating Elements.
- b. Bad Heating Elements.
- c. Very low line voltage delaying heat up.
- d. Temperature Safety Thermostat is opening prematurely, turning off the Heating Elements. This only applies to units with Microprocessors dated earlier than T93N5 or T93N6.
- e. A clogged Air Jet.
- f. An Air Outlet Valve stuck closed.

### **LOW TEMP**

This message is displayed if the Cycle Fail indicator lights, the cycle is aborted and the temperature drops 4.5°F (2.5°C) below the required sterilization temperature.

Possible causes for this message are:

- a. Insufficient water in the Chamber (see Low Water message).
- b. The sterilization phase of the cycle has been set for too long a period of time, allowing the Chamber water to boil away and the Chamber to run dry.
- c. The Temperature Safety Thermostat is opening prematurely, turning off the Heating Elements -- this only applies to units with Microprocessors dated earlier than T93N5 or T93N6.
- d. A bad Temperature Sensor.

### **LOW PRES**

This message is displayed, the Cycle Fail indicator lights, and the cycle is aborted if the pressure drops 4 PSI (0.27 BAR) below the required sterilization pressure.

Possible causes for this message are:

- a. Insufficient water in the Chamber (see Low Water message).
- b. The Heating Elements are not cycling on and off properly.
  1. Problem is with the Solid State Relay.
  2. Problem with the control circuit.
- c. Bad Heating Elements -- not producing enough wattage.
- d. The Temperature Safety Thermostat is opening prematurely, turning off the Heating Elements -- this only applies to units with Microprocessors dated earlier than T93N5 or T93N6.
- e. A bad Pressure Transducer.

- HIGH TEMP** This message is displayed, the Cycle Fail indicator lights and the cycle is aborted if the temperature rises 9°F (5°C) above the required sterilization temperature during the Sterilization phase of the cycle.  
This message will also be displayed if the Temperature Sensor is damaged. In this case, the message will appear just before the Heat phase starts.
- Possible causes for this message are:
- a. The Heating Elements are remaining on instead of cycling on and off.  
Check for a shorted Solid State Relay, shorted Heating Element or other short circuit.
  - b. This message can **ALSO** indicate a bad Temperature Sensor -- the message will display anytime during the Heat Up phase.
- HIGH PRES** This message is displayed, the Cycle Fail indicator lights, and the cycle is aborted if the pressure rises 10 PSI (0.6 BAR) above the required sterilization pressure.
- Possible causes for this message are:
- a. The Heating Elements are remaining on instead of cycling on and off.  
Check for a shorted Solid State Relay, shorted Heating Element or other short circuit.
  - b. The Sterilization temperature has been set above 274°F.
- MAN STOP** This message will be displayed and the Cycle Fail indicator will light after the **STOP Key** is depressed for longer than 1 second.
- RENEW WATER** This message is displayed only as information to the operator that the Water Reservoir should be drained and refilled with clean distilled water. This message will only appear on units with Microprocessors having software version numbers earlier than and including T93N5.
- POWER DN** This message is displayed, once the power is restored, after a power failure occurs during the running of a cycle. The **POWER DN** message will be displayed for several seconds, and if present, the Printer will print **POWER DN** on the print out.
- Once power has been restored the autoclave will make an attempt to resume the current cycle from the point at which it was interrupted.



- ◆ If a power failure occurs during the Heat Up phase, heating will resume (provided there is enough water in the Chamber. If not, the cycle will be aborted).
- ◆ Exhaust and Dry phases will automatically resume operation once power is restored.
- ◆ If the power down occurred during the Sterilization portion of the cycle, when power is restored, the autoclave will check if the temperature in the Chamber has fallen more than 4.5°F (2.5°C). If not, the Sterilization Cycle will resume automatically. If, however, when the power returns and the system determined that the temperature has fallen more than 4.5°F (2.5°C), the Sterilization Cycle will abort and the Exhaust Cycle will start.
- ◆ If a power failure occurs during the Liquids program, the system will not allow a fast exhaust (as the exhaust valve is normally closed), nor will it fast exhaust when power comes back on.

**ADD WATER** This message is displayed and the ADD WATER indicator lights to show insufficient water in the Water Reservoir. If this message is displayed after the **START Key** has been pressed, the system is not allowed to proceed. After water is added to the Reservoir, the **START Key** must be depressed again in order for the selected cycle to begin.

**DOOR UNLOCK** This message will be displayed and the **DOOR CLOSED** indicator will remain unlit if the door is improperly closed when the **START Key** is depressed. Once the door is properly closed, the **DOOR CLOSED** indicator will light and the **START Key** should be depressed to start the desired cycle. If the door becomes ajar during any stage of the cycle, the same message and indicator will appear, and the system will abort, the Cycle Fail indicator will light and the **DOOR UNLOCK** message will be displayed.

**WATER INLET** This message will be displayed as information to the operator while water is entering the Chamber, during the Automatic Water Filling process.

**CYC FINISHED** This message is displayed at the end of a successfully completed cycle.

## 5 Operating Instructions

### 5.1 Preparation Before Sterilizing

**Note: These instructions are provided as a minimum guideline.**

Instruments to be sterilized must be free from all residual matter, such as blood or organic tissue. Instruments must also be dry and free from mineral deposits. Such substances may cause damage to the instruments themselves or the Sterilizer.

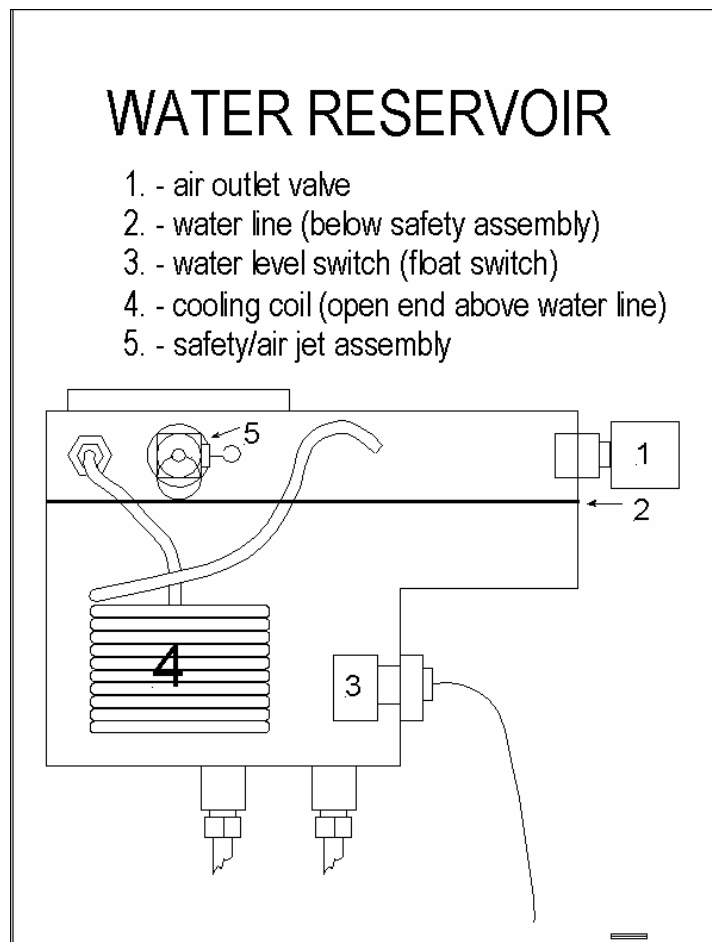
1. Clean instruments immediately after use to remove any residue. It is recommended that all instruments be ultrasonically cleaned using Tuttnauer's **CLEAN AND SIMPLE** enzymatic cleaning tablets or other suitable solution.
2. After cleaning, rinse instruments for 30 seconds and pat or air dry.
3. Follow the instrument manufacturer's instructions on the use of products for cleaning and lubricating instruments that have been ultrasonically cleaned.
4. Be sure that instruments of dissimilar metals (stainless steel, carbon steel, etc.) are separated. Carbon steel instruments should be bagged or placed on autoclavable towels and not directly on stainless steel trays.
5. When using a paper/plastic bag, the plastic side should always be down.
6. Check the instructions of the item manufacturer as to the proper procedure for sterilizing each item.
7. Items must be sterilized in an open position. Surfaces that are hidden because the item is in a closed position will not be exposed to the steam and will not be sterilized.
8. Place a sterilization indicator in each tray or inside each wrapped pack.
9. At least once a week use a biological spore test (*Bacillus Stearothermophilus*) in any load to insure proper sterilization, (be aware testing standards may vary). Always follow the spore test manufacturer's instructions.
10. Make sure that all instruments remain apart during the sterilization cycle. Surfaces that are hidden because items are covering other items will not be exposed to the steam and will not be sterilized.
11. Empty canisters should be placed upside-down in order to prevent the accumulation of water.

12. Do not overload the Sterilizer trays. Overloading will cause inadequate sterilization and drying (see table 9.7 for loading limits for each model).
13. Allow a distance of approximately 1" between trays to permit steam circulation.
14. Wrapped instruments should be placed in material, which will allow steam penetration and promote drying, such as an autoclave bag, autoclave paper, or muslin towels.
15. Do not stack pouches. It is recommended that a pouch rack, such as the Tuttnauer Pouch Rack, be used to insure proper steam penetration and adequate drying. Surfaces that are hidden because the items are being stacked will not be exposed to the steam and will not be sterilized.
16. Tubing should be rinsed after cleaning. When placed in the tray, make sure that both ends of the tubing are open and there are no sharp bends or twists.
17. Packs should be placed upright on the tray. They should not be touching each other or the Chamber walls. There should be about 1" between packs for proper steam circulation.
18. Liquids should only be sterilized in heatproof glass. The beaker should only be filled 2/3 full and the lid should be on loosely to allow for expansion (see the table 9.9 for the maximum liquid capacity for each model).
19. If spotting were detected on the instruments, the first step would be to use an ordinary eraser to remove the spot. If there is no pitting under the spot, the spot was only dirt. Dirt spots on an instrument may be an indication that the autoclave needs to be cleaned or that the instruments were not adequately cleaned or dried. If removal of the spot reveals pitting, the spot was most likely rust. Rust spots on an instrument are not uncommon on inexpensive instruments. It may also be an indication that the instruments were rinsed in tap water with a high content of minerals. These minerals when exposed to high temperature and steam will accelerate the oxidation of the metal. One suggestion would be to final rinse the instruments in distilled water.
20. If the instruments exhibit a discoloration, this can be due to the mixing of carbon steel and stainless steel. When these two metals come into contact with each other, electrolysis occurs that breaks down the metal. The best solution is to separately wrap the carbon steel to insulate it from other instruments or the trays.
21. Items should not be allowed to touch the walls of the Chamber as the hot metal can damage the item.

## 5.2 Filling The Reservoir

Always use **DISTILLED WATER** in the autoclave for sterilizing. Using water of a poorer quality will cause increased maintenance due to the mineral residue that accumulates in the various parts of the autoclave.

The Reservoir is filled from the top of the autoclave. Remove the Reservoir Cover and pour water through the opening. Continue filling until the water reaches the base of the Safety Valve Holder. **Under no circumstances should the Reservoir be filled above the Safety Valve Holder.** The Reservoir should never be filled while the autoclave is running a cycle. If the Reservoir is filled while the Autoclave is running, at the end of the cycle, water exhausted from the Chamber can cause the Reservoir to overflow.



Overfilling or the failure to use **Distilled Water** will lead to clogging of the hole in the Air Jet. This will be evidenced by the lack of both a hissing sound and a stream of steam coming from the Air Jet during sterilization. When this situation occurs, follow the instructions in sec. 6.5 for cleaning the Air Jet.

## 5.3 Sterilization Programs

### Program 1 – Unwrapped Instruments

This program is for sterilizing unwrapped instruments and materials, that the manufacturer of these items has recommended autoclaving, at a temperature between 250°F and 274°F (121°C and 134°C).

This program comes set with these default parameters:

Sterilization temperature	273°F
Sterilization time	3 minutes
Dry time	none

These values can be altered to fit the needs of a particular office.

The parameters can only be changed while the autoclave is not running a cycle.

Press the **TEMP Key** and a cursor will appear under the temperature parameter. Use the **Up/Down Arrow Keys** to change to the desired temperature. The acceptable range for proper sterilization of unwrapped items is between 250°F and 274°F (121°C and 134°C).

**\*\*\* Caution – in no case should the temperature be set higher than 274°F (134°C) \*\*\***

Any change of temperature must be coordinated with a corresponding change in sterilization time.

Press the **STE TIME Key** and a cursor will appear under the sterilization time parameter. Use the **Up/Down Arrow Keys** to change to the desired sterilization time.

If drying is desired, press the **DRY TIME Key** and a cursor will appear under the dry time parameter. Use the **Up/Down Arrow Keys** to change to the desired dry time. The acceptable range for drying time is 0 to 99 minutes.

After a few seconds of inactivity the cursor will disappear and the parameter will be locked in.

## Program 2 – Wrapped Instruments

This program is for sterilizing wrapped instruments and materials, that the manufacturer of these items has recommended autoclaving, at a temperature between 250°F and 274°F (121°C and 134°C).

This program comes set with these default parameters:

Sterilization temperature	273°F
Sterilization time	7 minutes
Dry time	30 minutes

These values can be altered to fit the needs of a particular office.

The parameters can only be changed while the autoclave is not running a cycle.

Press the **TEMP Key** and a cursor will appear under the temperature parameter. Use the **Up/Down Arrow Keys** to change to the desired temperature. The acceptable range for proper sterilization of unwrapped items is between 250°F and 274°F (121°C and 134°C).

**\*\*\* Caution – in no case should the temperature be set higher than 274°F (134°C) \*\*\***

Any change of temperature must be coordinated with a corresponding change in sterilization time.

Press the **STE TIME Key** and a cursor will appear under the sterilization time parameter. Use the **Up/Down Arrow Keys** to change to the desired sterilization time.

If a longer or shorter drying is desired, press the **DRY TIME Key** and a cursor will appear under the dry time parameter. Use the **Up/Down Arrow Keys** to change to the desired dry time. The acceptable range for drying time is 0 to 99 minutes.

After a few seconds of inactivity, the cursor will disappear and the parameter will be locked in.

### Program 3 – Liquids/Glassware

This program is for sterilizing liquid solutions, distilled water, medicines and other liquid preparations or glassware. For proper liquid sterilization, it is recommended that only the default parameters be used. For sterilizing glassware, the parameters can be altered to fit the needs of the office. In either case there is no rapid exhaust. The unit will slow exhaust at the end of the sterilization cycle, it will take approximately 15 minutes.

This program comes set with these default parameters:

Sterilization temperature	250°F
Sterilization time	30 minutes
Dry time	drying is not available

### Program 4 – Extra Drying Cycle

The purpose of the **Extra Drying Cycle** is to offer an alternative in situations where the dry time in the wrapped or unwrapped cycle is insufficient. Rather than wait for the items to air dry or run another complete cycle with a longer dry time, just select the **Extra Drying Cycle** to continue the heat assisted drying process.

This program comes set with these default parameters:

Dry time	30 minutes
----------	------------

These values can be altered to fit the needs of a particular office.

If a longer or shorter drying is desired, press the **DRY TIME Key** and a cursor will appear under the dry time parameter. Use the **Up/Down Arrow Keys** to change to the desired dry time. The acceptable range for drying time is 0 to 99 minutes.

After a few seconds of inactivity, the cursor will disappear and the parameter will be locked in.

## 5.4 Operating Instructions

Plug the autoclave in.

Remove the Water Reservoir Cover and pour **DISTILLED WATER** into the Reservoir. Fill the reservoir until the water reaches the base of the Safety Valve Holder. This amount is approximately 2 quarts for the 1730, 2340 and 2540 models and approximately 4 quarts for the 3850 and 3870 models. Do not overfill the Reservoir and do not fill while the autoclave is running a cycle, (see sec. 5.2 for more detail).

Turn on the **On/Off Rocker Switch** that is located at the bottom of the Front Console Panel.

If a Printer is installed, use the **CLOCK Key** to set the proper date and time (see sec. 3.1 for more detail).

Select the desired program by pressing the appropriate program key. The light indicator for that program will light, indicating that that program has been selected. The parameters for that program will then be displayed (see sec. 5.3 for more detail).

Load the material to be sterilized into the Chamber, close the door making sure that the door is closed securely and the **DOOR CLOSED** indicator is illuminated (see sec. 5.1 for more detail).

**Note:** Due to the inherent elasticity of the door gasket, the close door indicator light may be illuminated green before a complete seal is made between the door and the chamber.

Therefore, in order to insure that the door is fully sealed when the green light has been illuminated, continue to tighten the door bolt until hand tight. Do not overtighten the bolt as this may result in damage to the gasket.

Press the **START Key** to begin the cycle.

The **START** indicator will light.

The **WATER INLET** message will be displayed while the Chamber is filling.

Once the Chamber has filled with water, the **HEAT** indicator will illuminate indicating that the Chamber is beginning to heat up.

The actual temperature and pressure inside the Chamber will be displayed continuously during the remainder of the cycle. If a Printer is installed, these values will be printed throughout the cycle.

After the unit has heated to the proper temperature, the autoclave will automatically proceed to the sterilization part of the cycle and the **STE** indicator will light.



At the end of the sterilization part of the cycle the autoclave will automatically exhaust and the **EXHAUST** indicator will light.

When the autoclave has finished exhausting, it will proceed automatically to the drying part of the cycle if drying has been programmed. At this time, the **DRY** indicator will light. On EA, EKA EZ and EZ10k models, the Dry Pump will automatically come on. The sound of an air compressor can be heard as it sucks air through a HEPA filter and forces that air through the Chamber to produce a fast and thorough drying.

**Note:** Damp or wet packs or wrapped items removed from the autoclave can very easily become contaminated. Make sure that wrapped items are thoroughly dry before removing them from the autoclave. Only thoroughly dry packs will protect the sterilized items. It is important to remember that when using paper/plastic bags, the plastic side should always be down.

When the cycle is completely finished, a buzzer will sound for approximately 5 seconds and the **START** light will turn off. A message will be displayed saying **CYC FINISHED**.

Open the door and remove the sterilized material. The autoclave is now ready for the next cycle.

**Note:** Newer version autoclaves are programmed to wait a minimum of 10 minutes between cycles. This is to avoid overheating the autoclave under conditions of a very heavy workload.

## 5.5 Standard Sterilization Temperatures & Times for a Steam Sterilizer

Type of Load	Temperature	Pressure	Time
<b>Unwrapped Items</b>	273°F (134°C)	30 psi	3 min
	250°F (121°C)	15 psi	15 min
<b>Lightly Wrapped</b> (Bagged or paper towel wrapped)	273°F (134°C)	30 psi	7 min
	250°F (121°C)	15 psi	20 min
<b>Heavily Wrapped</b> (Double bagged or cloth wrapped)	273°F (134°C)	30 psi	10 min
	250°F (121°C)	15 psi	25 min

These times and temperatures are approximate and are intended only as a guide. The exact time required for sterilization will depend not only on the choice of temperature but also on size and compactness of the load.

**Spore testing is your only assurance of proper Sterilization technique**

## 6 Maintenance

### 6.1 Cleaning the Autoclave

#### 6.1.1 Chamber Cleaning

- ◆ The Chamber and internal plumbing of your Tuttnauer Autoclave must be cleaned once per week or every 20 to 25 cycles with **Chamber Brite** autoclave cleaner.
- ◆ Tuttnauer's **Chamber Brite** autoclave cleaner has been formulated specifically to be a fast, powerful and easy to use cleaner for steam sterilizers (see detailed instructions in sec. 9.16).
- ◆ If the autoclave is not cleaned regularly, dirt and debris will build up and clog the Tubing and Solenoid Valves. This dirt can also be transmitted to the instruments during sterilization. In addition, a layer of dirt on the stainless steel Chamber traps moisture against the metal and will lead to the Chamber becoming porous and failing.
- ◆ **NEVER use bleach, steel wool, a steel brush or anything abrasive to scrub or clean the Chamber.**

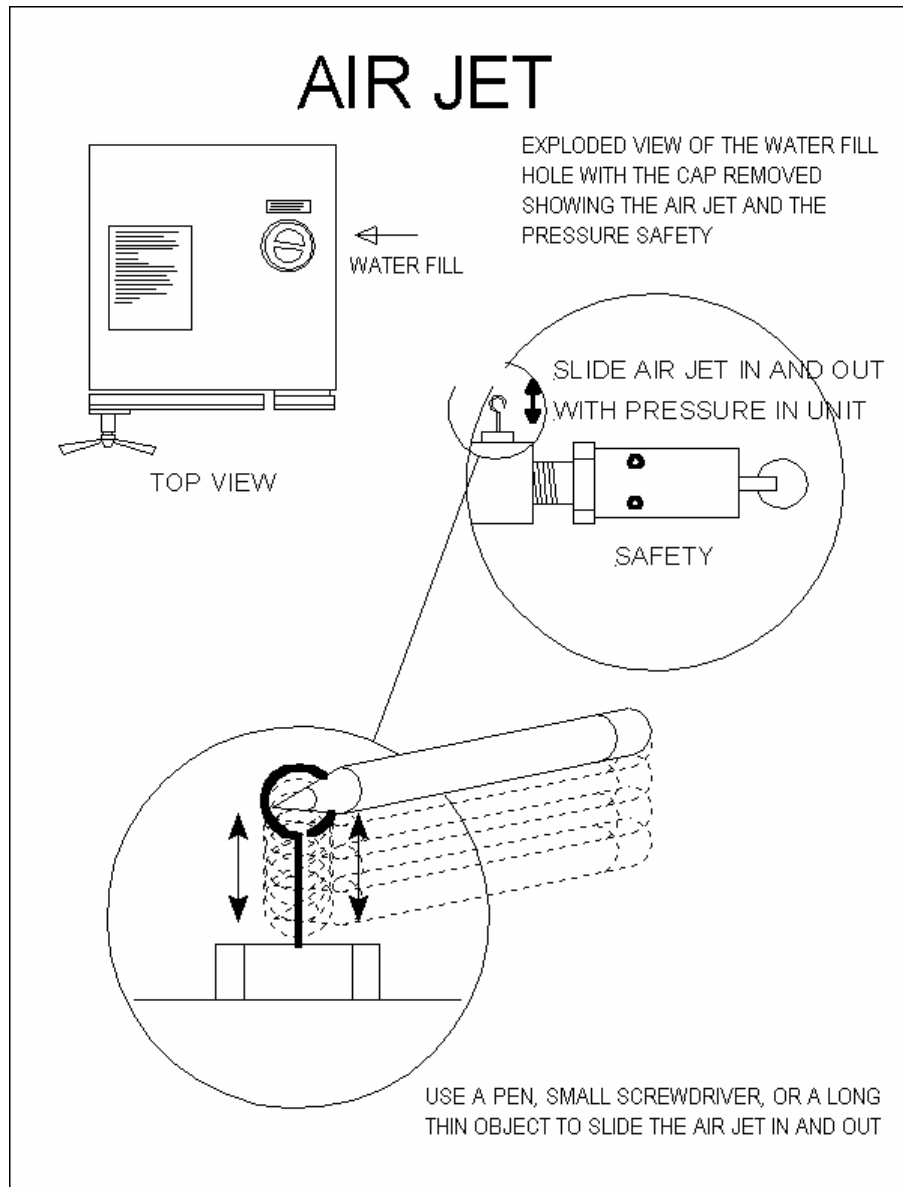
#### 6.1.2 Air Jet Cleaning

##### **A dirty Air Jet is the number one cause of failed spore tests**

The Air Jet, which is located just inside the Water Reservoir, must be cleaned once per week or more often, if necessary, to remove any accumulated dirt and debris.

Remove the Water Reservoir cover.

- ◆ With an object similar to a pen or screwdriver, snag the loop on the end of the clean out wire protruding from the Air Jet.
- ◆ Move that clean out wire in the Air Jet back and forth 10 times.
- ◆ It is preferred to do this when the unit is running a cycle so any loosened debris will be blown away. However, it can be done while the unit is idle.

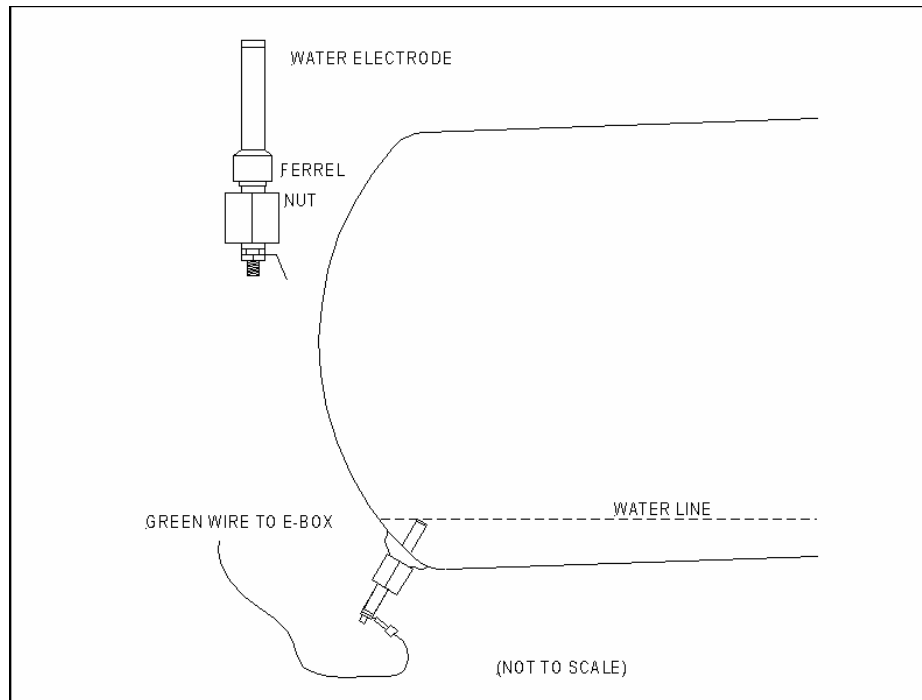


### 6.1.3 Cleaning the Water Sensing Electrode

The Water Sensing Electrode must be cleaned a least once per week to insure proper filling of the Chamber at the beginning of each cycle. In addition, cleaning the sensor will insure that the Electrode properly senses the water level throughout the cycle to prevent the Chamber from running dry.

In some situations where the Chamber itself is not cleaned regularly or **Distilled Water** is not being used, it may be necessary to clean the Electrode more frequently.

Using a damp cloth or sponge, you may use a mild soapy solution if you like, wipe down the Water Sensing Electrode. The electrode is located at the rear of the Chamber. It is important to wipe the sides of the electrode as well as the tip, to remove any dirt and debris that may have built up.



#### 6.1.4 Tray and Tray Holder Cleaning

Once per week the tray holder and trays need to be cleaned with a non-abrasive stainless steel cleaner. Several of these types of cleaners can be found in a local supermarket.

**Do not use bleach, steel wool, a steel brush or anything abrasive to clean the trays or tray holder.**

#### 6.1.5 Clean the Outer Cabinet

Once per week clean the Outer Cabinet with a soft cloth and a mild soapy solution. Products like Fantastic or Windex are okay to use for this type of cleaning. Avoid using harsh chemicals and disinfectants on the Keypad as this can cause the outer membrane on the Keypad to deteriorate.

## 6.1.6 Safety Valve Cleaning

For safety reasons, the ASME (American Society of Mechanical Engineers) recommends that the Safety Valve, which is located just inside the Water Reservoir, be cleaned every month to remove accumulated dirt and debris [see sec. 6.9].

Accumulations of dirt can cause the valve to malfunction resulting in the possibility of the Chamber reaching dangerously high pressures.

Begin a normal sterilization cycle according to the operating manual instructions.

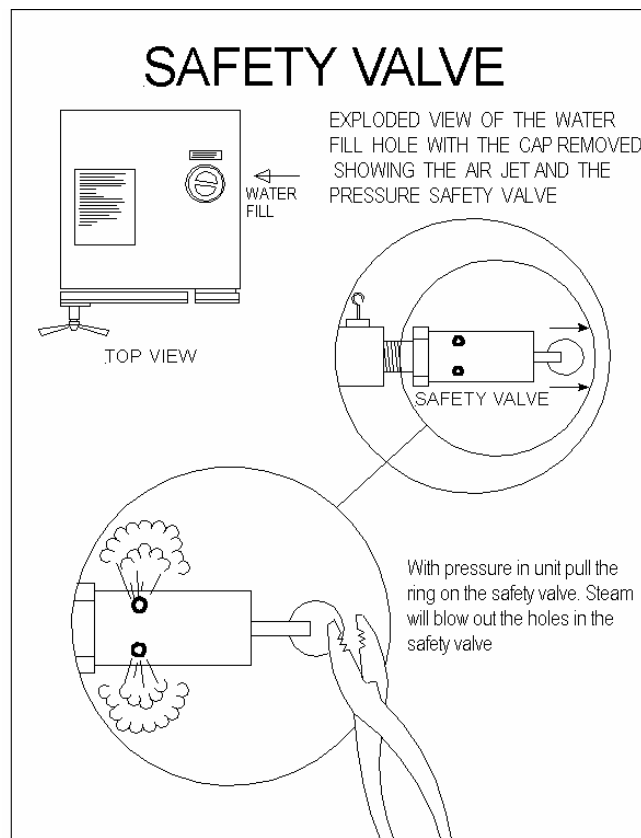
- ◆ Allow a pressure of approximately 30 psi to build up in the Chamber.
- ◆ Turn the power off.
- ◆ Remove the Water Reservoir Cover.

**CAUTION - This next step will expose you to HOT STEAM.**

**CAUTION - To avoid being burned, by hot steam, do not place your face or hands over the safety valve.**

- ◆ Pull the large ring of the Safety Valve using a screwdriver, hook, pliers or other tool. Hold the Safety Valve open for 2 seconds.

The escaping steam will clean debris away from the seat of the valve.



### **6.1.7 Clean the Door Gasket**

Wipe the Door Gasket once per day with a damp cloth or sponge; you may use a mild soapy solution if you like.

### **6.1.8 Cleaning the Filters**

Filter cleaning is done on an as needed basis.  
See sec. 6.11 for details on cleaning the different filters.

## 6.2 Door Assembly Maintenance

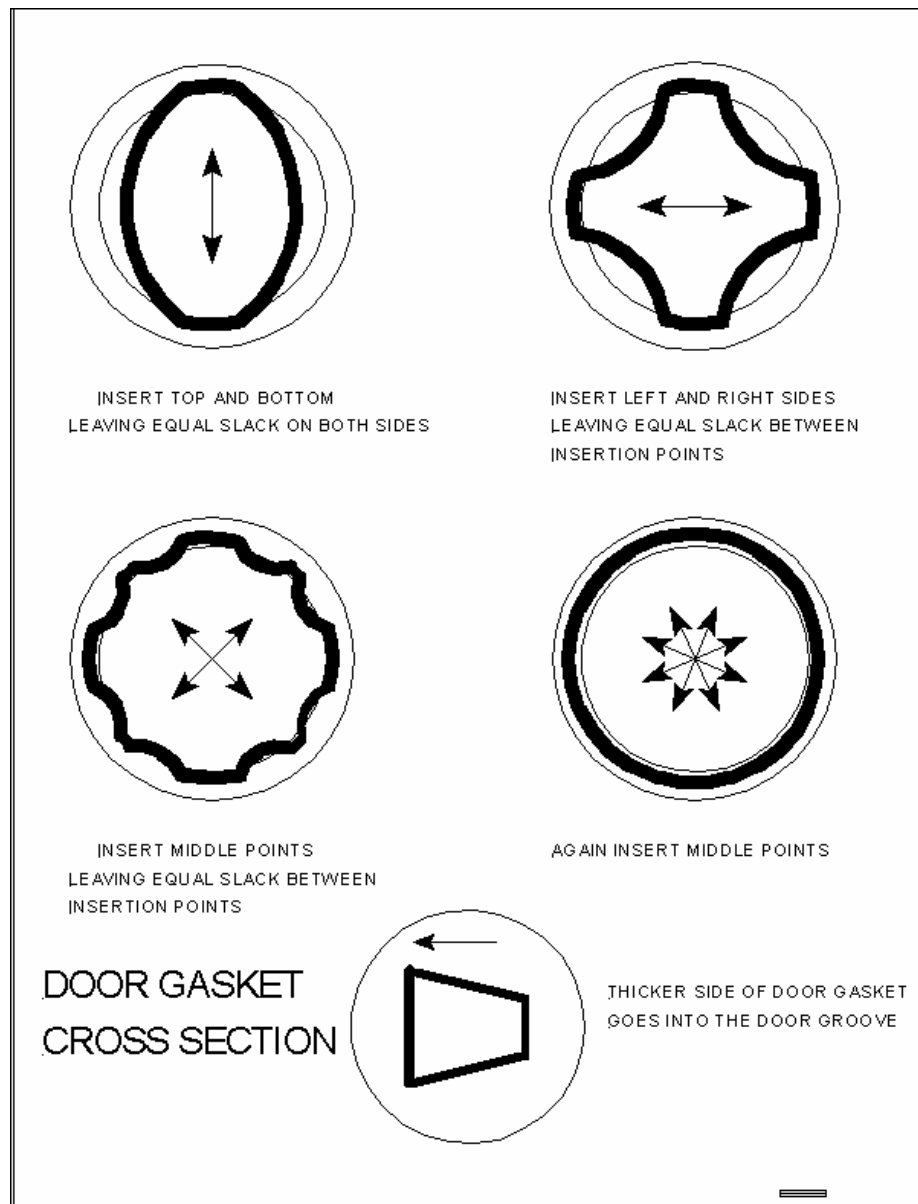
### 6.2.1 Lubrication

Put two drops of multipurpose oil on the Door Hinge Pin once each week.

### 6.2.2 Door Gasket Installation

The Door Gasket has a slight taper. The wider side is inserted into the Door first.

Install the gasket as per the diagram.





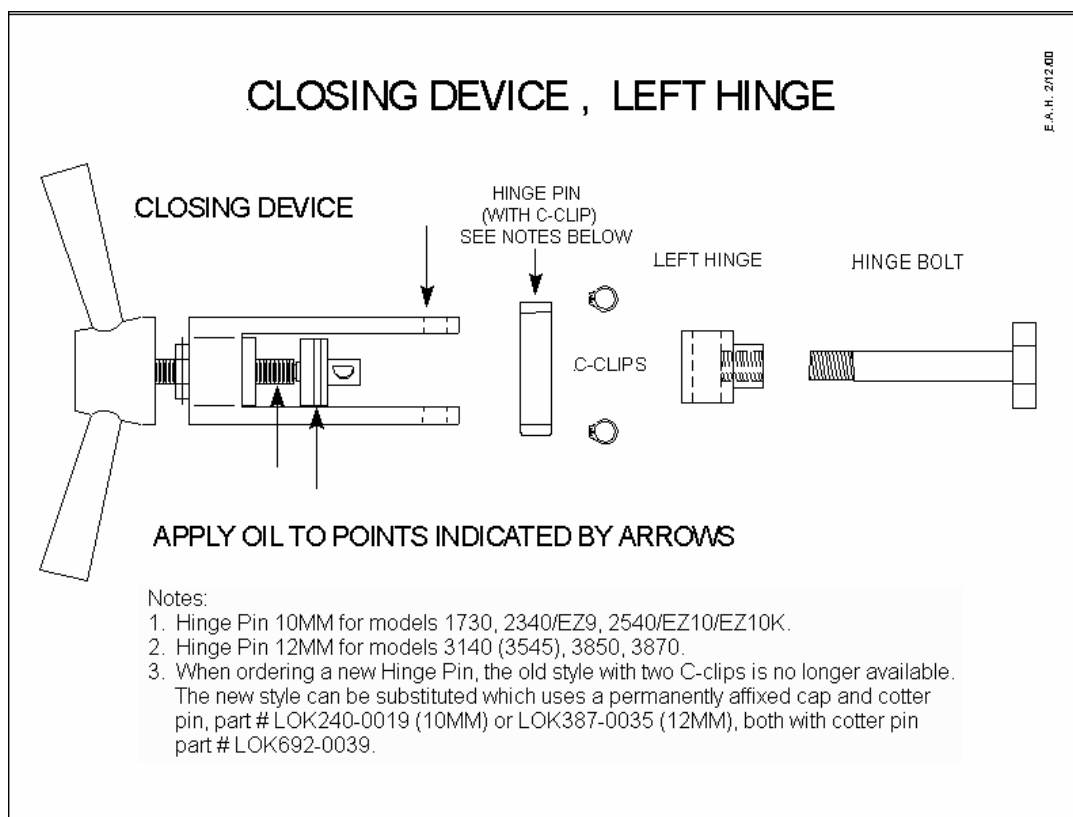
## 6.3 Closing Device Maintenance

### 6.3.1 Lubrication

- ◆ Put two drops of multipurpose oil on the Closing Device Hinge Pin once each week.
- ◆ Put two drops of multipurpose oil on the threaded shaft of the Closing Device. Place these drops as close to the Bridge as possible.
- ◆ Put two drops of multipurpose oil on the rotating bearing of the Closing Device. This will prevent the bearing from grinding against the door.

### 6.3.2 Hinge Pin

- ◆ Inspect the hinge pin and c-clips once per week.
- ◆ Make sure the top and bottom c-clips are in place on the hinge pin.
- ◆ Make sure the bridge supports are straight and not in danger of creeping off the hinge pin.
- ◆ Newer units will have a cotter pin securing the bottom of the hinge pin. Make sure the cotter pin is in place.



## 6.4 Solenoid Valves

### 6.4.1 Filter Screen Cleaning

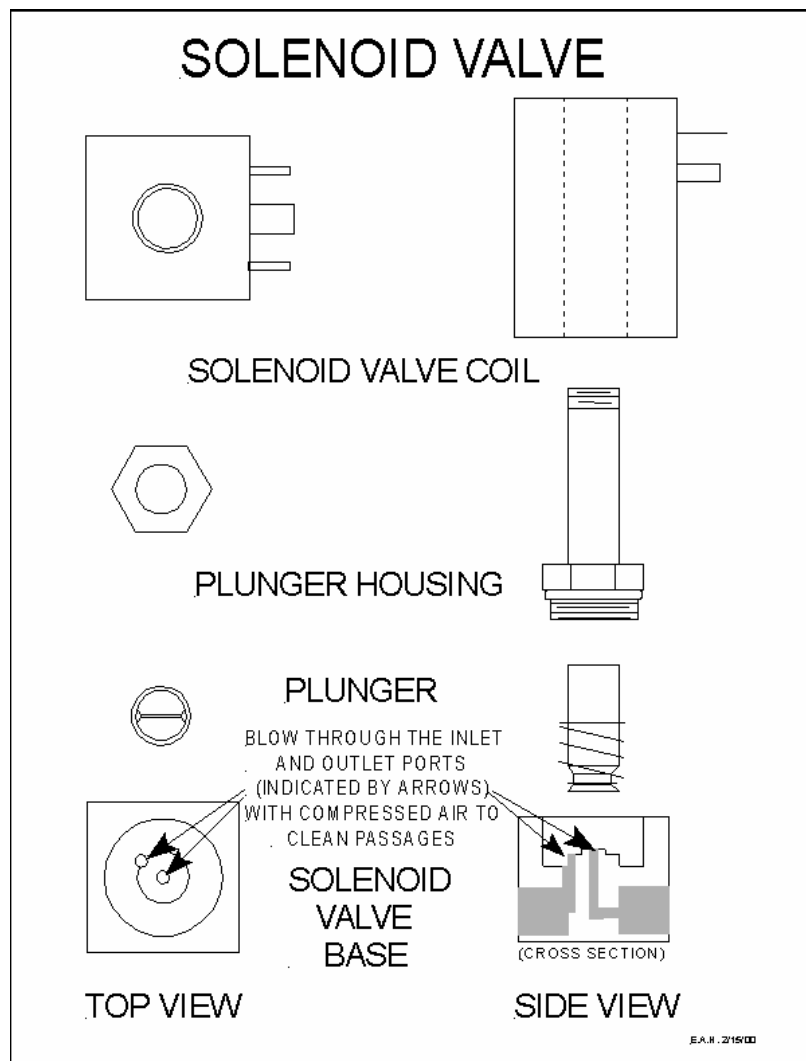
On models with serial numbers beginning with 93 and continuing to numbers beginning with 96, there is a brass disk on the rear of the machine. This disk is held in place with (3) three 3mm Allen screws and holds the Filter Screen in place.

- ◆ Before removing these screws, make sure the Chamber and Reservoir are empty of any water. **WARNING the brass disk may be hot!**
- ◆ Remove the (3) three Allen screws and the brass disk.
- ◆ Remove the Filter Screen and clean any dirt and debris.
- ◆ Reinstall the Filter Screen and brass disk and secure with the three Allen screws.
- ◆ On models with serial numbers beginning with 00, there is a Chrome cap at the rear of the autoclave. Behind this cap there is a Filter Screen. Before removing the cap, make sure the Chamber and Reservoir are empty of any water. **WARNING the chrome cap may be hot!**
- ◆ Unscrew the cap.
- ◆ Remove the Filter Screen and clean any dirt and debris.
- ◆ Reinstall the Filter Screen and tighten down the cap.
- ◆ On units with serial numbers starting with 97 and continuing until 99, the only Filter is a plastic screen in the fill hole inside the Chamber.

### 6.4.2 Valve Cleaning

- ◆ When cleaning the Fill Valve, make sure the Reservoir and Chamber are empty of any water.
- ◆ When cleaning the Exhaust Valve, make sure the Chamber is empty of any water.
- ◆ When cleaning the Dry Pump Valve, make sure the Chamber is empty of any water.
- ◆ Remove the electrical coil by using a  $\frac{3}{4}$  inch wrench to loosen the retaining nut.
- ◆ Remove the Plunger Assembly using a  $\frac{7}{8}$ -inch wrench. **NEVER** use Vise Grips on the sleeve of the Plunger Assembly, doing so can damage the sleeve and cause the Plunger not to function.
- ◆ Inspect the sleeve for any dings or irregularities and if the sleeve shows any signs of damage, the Plunger Assembly should be replaced.
- ◆ Once the Plunger Assembly is removed, clean any dirt or debris from the inside of the sleeve and around the Plunger.
- ◆ If the Plunger or Plunger Sleeve shows any signs of rust, replace the Plunger Assembly.
- ◆ Inspect the Plunger seat for any irregularities.

- ◆ If the Plunger seat shows signs of damage or swelling, it should be replaced.
- ◆ Inspect the o-ring on the sleeve; if it is damaged, replace it.
- ◆ Insert the Plunger into the sleeve and make sure it is capable of moving in and out freely. If the Plunger does not move in and out freely, it should be replaced.
- ◆ Clean any dirt or debris from the valve base.
- ◆ Using compressed air, blow out both the incoming and outgoing passageways in the base.
- ◆ Inspect the valve base for damage.
- ◆ Using a magnifying glass, check the area where the Plunger seats for nicks or gouges that may cause leaking. If any damage is found, the base should be replaced.
- ◆ Once the valve assembly is cleaned and repaired, it can be reassembled.
- ◆ The Plungers do not require any lubrication.



## 6.5 Air Jet Maintenance

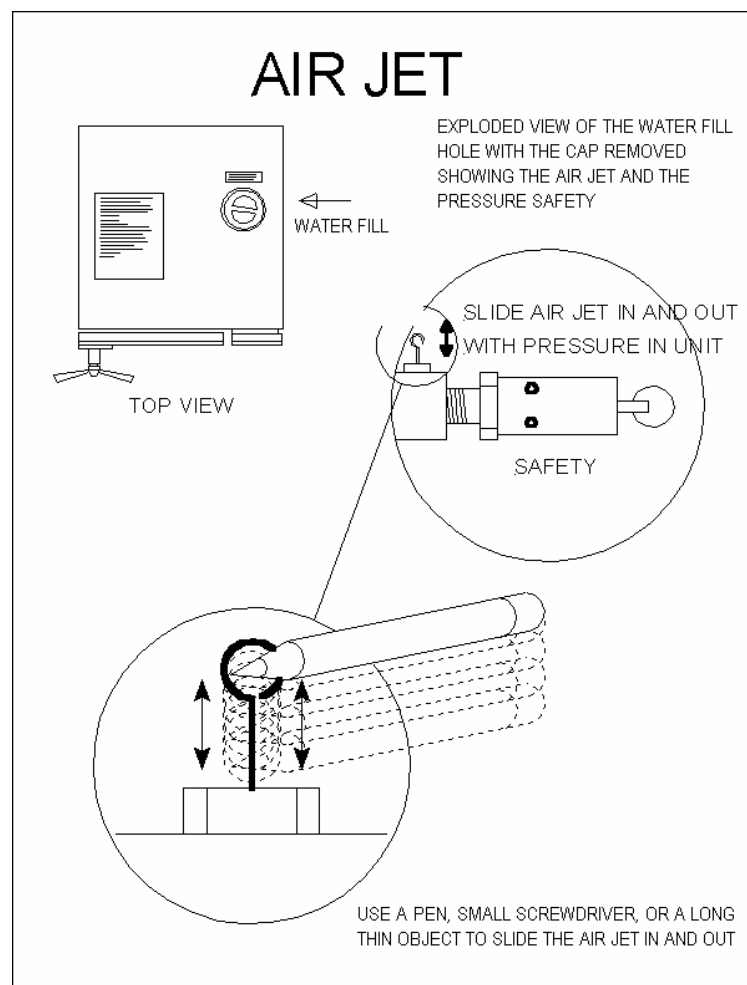
**A dirty Air Jet is the number one cause of failed spore tests.**

The Air Jet, which is located just inside the Water Reservoir, must be cleaned once per week or more often, if necessary, to remove any accumulated dirt and debris.

**Failure to keep the Air Jet clean will result in a malfunctioning of the autoclave.**

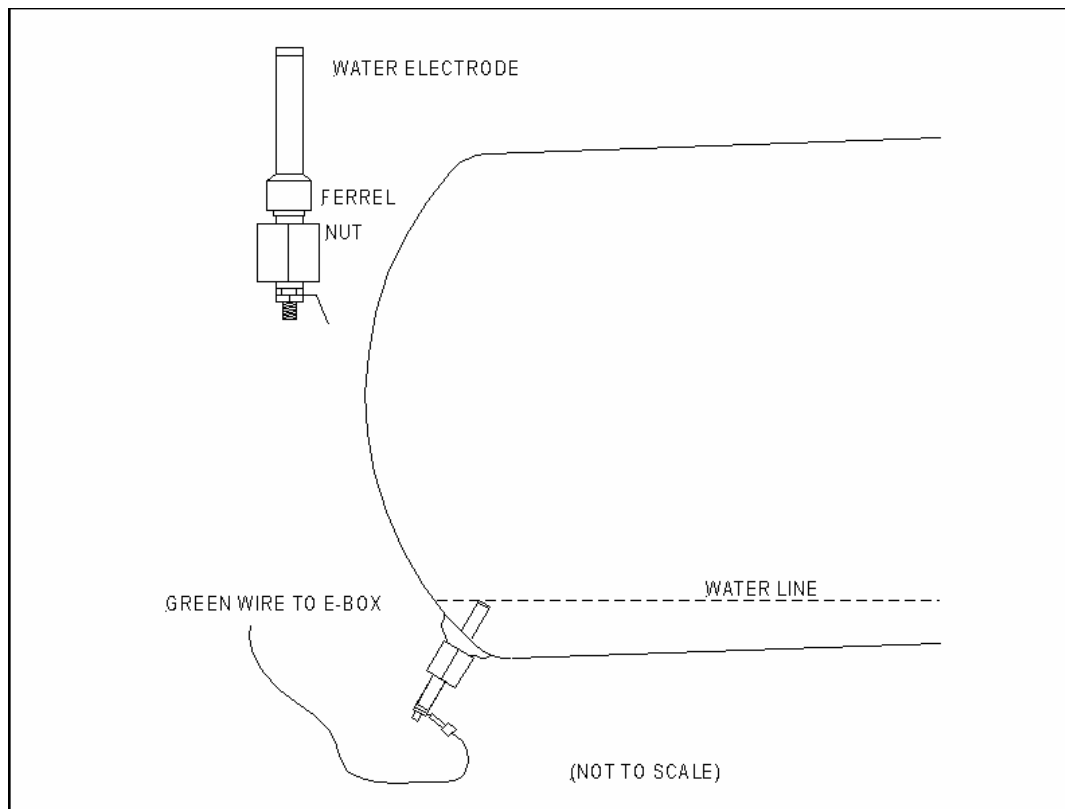
**This will be demonstrated by indicator strips that do not turn and failed spore tests.**

- ◆ Remove the Water Reservoir cover.
- ◆ With an object similar to a pen or screwdriver, snag the loop on the end of the clean out wire protruding from the Air Jet.
- ◆ Move that clean out wire in the Air Jet back and forth 10 times.
- ◆ It is preferred to do this when the unit is running a cycle and under pressure so any loosened debris will be blown away. However, it can be done while the unit is idle.



## 6.6 Water Sensing Electrode

- ◆ The Water Sensing Electrode must be cleaned a least once per week to insure proper filling of the Chamber at the beginning of each cycle. In addition, cleaning the sensor will insure that the Electrode properly senses the water level all during the cycle to prevent the Chamber from running dry.
- ◆ In some situations where the Chamber itself is not cleaned regularly or **Distilled Water** is not being used, it may be necessary to clean the Electrode more frequently.
- ◆ Using a damp cloth or sponge, you may use a mild soapy solution if you like; wipe down the Water Sensing Electrode. The electrode is located at the rear of the Chamber. It is important to wipe the sides of the electrode as well as the tip, to remove any dirt and debris that may have built up.



## 6.7 Chamber Maintenance

- ◆ The Chamber and internal plumbing of your Tuttnauer Autoclave must be cleaned once per week or every 20 to 25 cycles with **Chamber Brite** autoclave cleaner.
- ◆ Tuttnauer's **Chamber Brite** autoclave cleaner has been formulated specifically to be a fast, powerful and easy to use cleaner for use with any steam sterilizer (see detailed instructions in sec. 9.16).

**NEVER use bleach, steel wool, a steel brush or anything abrasive to scrub or clean the Chamber.**

- ◆ If the autoclave is not cleaned regularly, dirt and debris will build up and clog the Tubing and Solenoid Valves. This dirt can also be transmitted to the instruments during sterilization, which will result in spots appearing on the freshly sterilized instruments. Frequently these spots are mistaken for rust, but they are only dirt spots.
- ◆ In addition and of great importance is that if a layer of dirt is left on the stainless steel Chamber it will trap moisture against the metal. This condition of moisture trapped against the metal will lead to the Chamber becoming porous and failing.

## 6.8 Dry Pump Filter Maintenance

- ◆ The Air Filter located behind the gray cover on the right side of the autoclave needs to be changed once every one to two years.
- ◆ The indication that the Air Filter is ready to be changed is that the Dry Cycle is taking longer and longer to completely dry the packs.
- ◆ To change the Air Filter, unscrew the gray cover. As the cover is removed, the Air Filter will come out of the hole. Disconnect the old Air Filter from the silicone tubing and connect the new one.

## 6.9 Safety Relief Valve Maintenance

ASME requires that the Safety Valve, which is located just inside the Water Reservoir, must be cleaned every month to remove accumulated dirt and debris (see drawing below). Failure to do this can result in a suspension of the owner liability insurance.

Accumulations of dirt will cause the valve to leak, resulting in the inability of the autoclave to maintain pressure.

To clean:

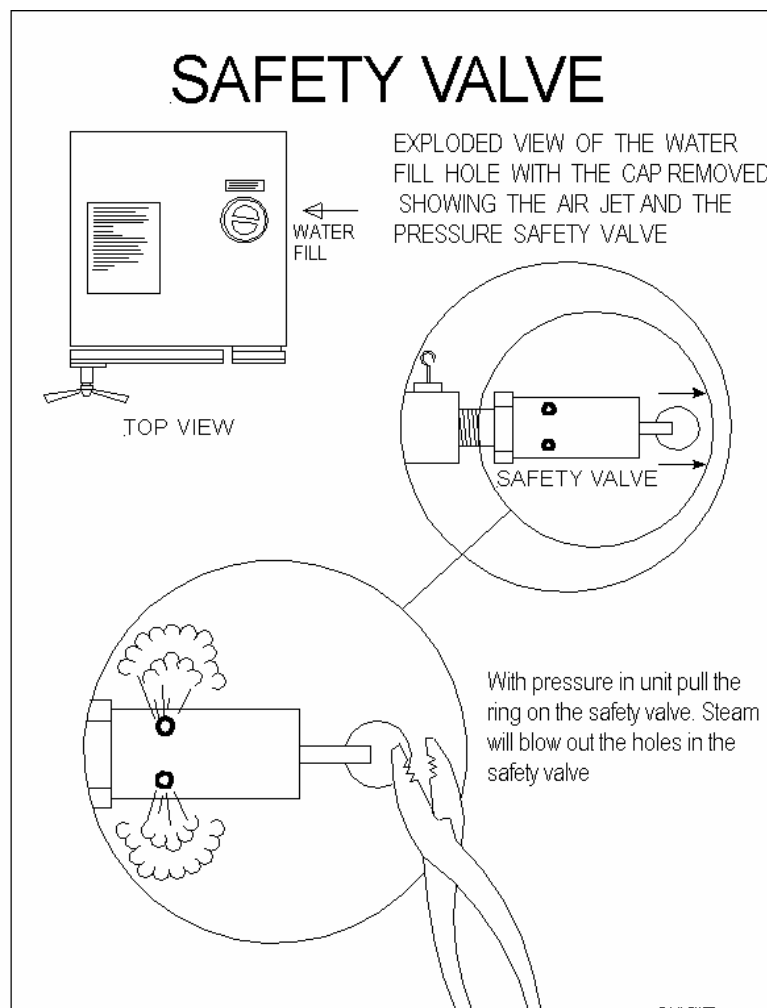
- ◆ Begin a normal sterilization cycle according to the operating manual instructions.
- ◆ Allow a pressure of approximately 30 psi to build up in the Chamber.

- ◆ Turn the power off.
- ◆ Remove the Water Reservoir Cover.

**CAUTION - This next step will expose you to HOT STEAM.**

**CAUTION - To avoid being burned by hot steam, do not place your face or hands over the safety valve.**

- ◆ Pull the large ring of the Safety Valve using a screwdriver, hook, pliers or other tool. Hold the Safety Valve open for 2 seconds.
- ◆ The escaping steam will clean debris away from the seat of the valve.

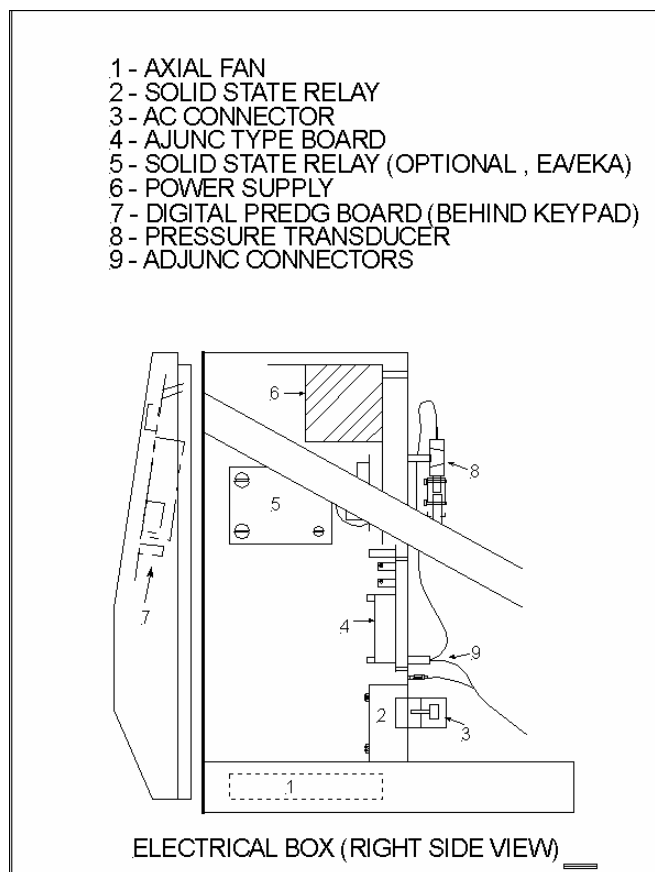


## 6.10 Printed Circuit Board Maintenance

Once per year or more often, depending on the cleanliness of the environment the autoclave is located in, remove any accumulations of dust from the Power Supply and surrounding circuit boards.

- ◆ First, make sure the unit is unplugged from the wall outlet.
- ◆ Remove the Outer Cabinet.
- ◆ Vacuum the dust from all the boards and components in the Electronic Box. Vacuuming is important to insure that the dust is removed and is not allowed to resettle on the boards.
- ◆ Using compressed air or one of the aerosol can products made for cleaning circuit boards; blow off any dust that may have escaped the vacuum.

**Dust buildup on a circuit board can conduct electricity. A dust trail across the circuit board can cause that board to short out. In addition, a layer of dust on the boards and components restricts airflow and that can lead to the circuit boards overheating.**





## 6.11 Filter Maintenance

### 6.11.1 Bronze Water Reservoir Filter

For autoclaves built between 1/93 and 1/95.

- ◆ Drain the Reservoir.
- ◆ Unscrew the bronze Reservoir Filter from the bottom of the Reservoir.
- ◆ Clean in an ultrasonic cleaner for 5 – 10 minutes or replace with a new filter.

### 6.11.2 Filter Screen in Battery of Solenoids

For autoclaves built between 1/93 and 9/96.

On the rear of the unit you will find a brass disk with three Allen screws (3mm). **Caution, the brass disk can be hot!**

- ◆ Make sure the Chamber is empty and remove the disk.
- ◆ Remove the metal screen and clean.
- ◆ Replace the screen and reinstall the brass disk, securing it with the three Allen screws.

### 6.11.3 Plastic Chamber Screen

For autoclaves built between 1/98 and 1/2000.

There is a plastic screen located in the fill hole at the back of the Chamber.

- ◆ Remove the Chamber Screen using a hooked probe and pulling straight out.
- ◆ Clean under running water or replace.

### 6.11.4 Chamber Strainer

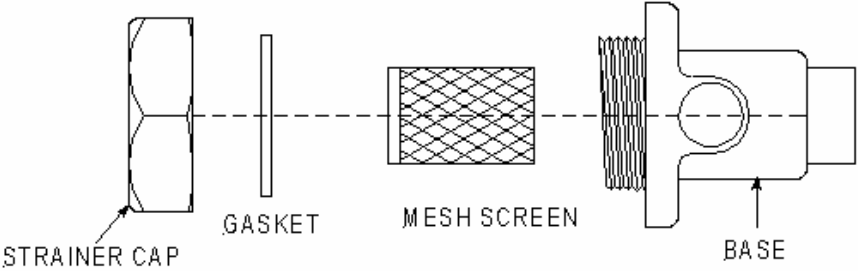
Units repaired at Tuttnauer after 2/2000 will have a Chamber Strainer located in the left rear corner inside the autoclave. Newer units will have an external strainer with a Chrome Cap on the back of the autoclave.

**Caution, either of these devices can be hot!**

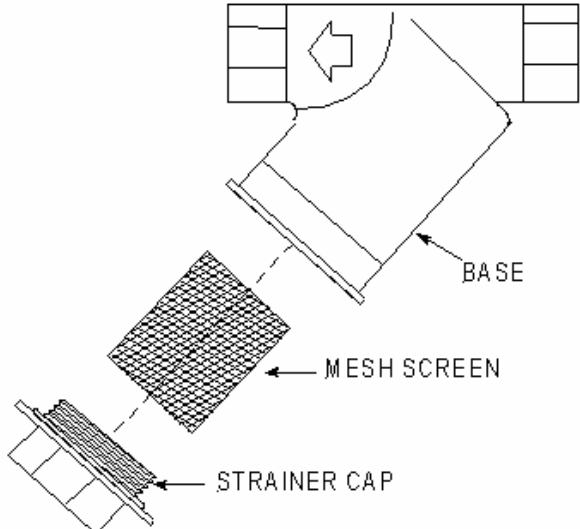
Behind this cap is a Filter Screen.

- ◆ Before removing the cap, be sure the Chamber is empty of any water.
- ◆ Remove the cap to clean the strainer. Units with internal strainers will need to have the Outer Cabinet removed to access the strainer. Once the Outer Cabinet is removed, open and clean the strainer.
- ◆ Replace the screen and tighten down the cap.

### CHAMBER STRAINER



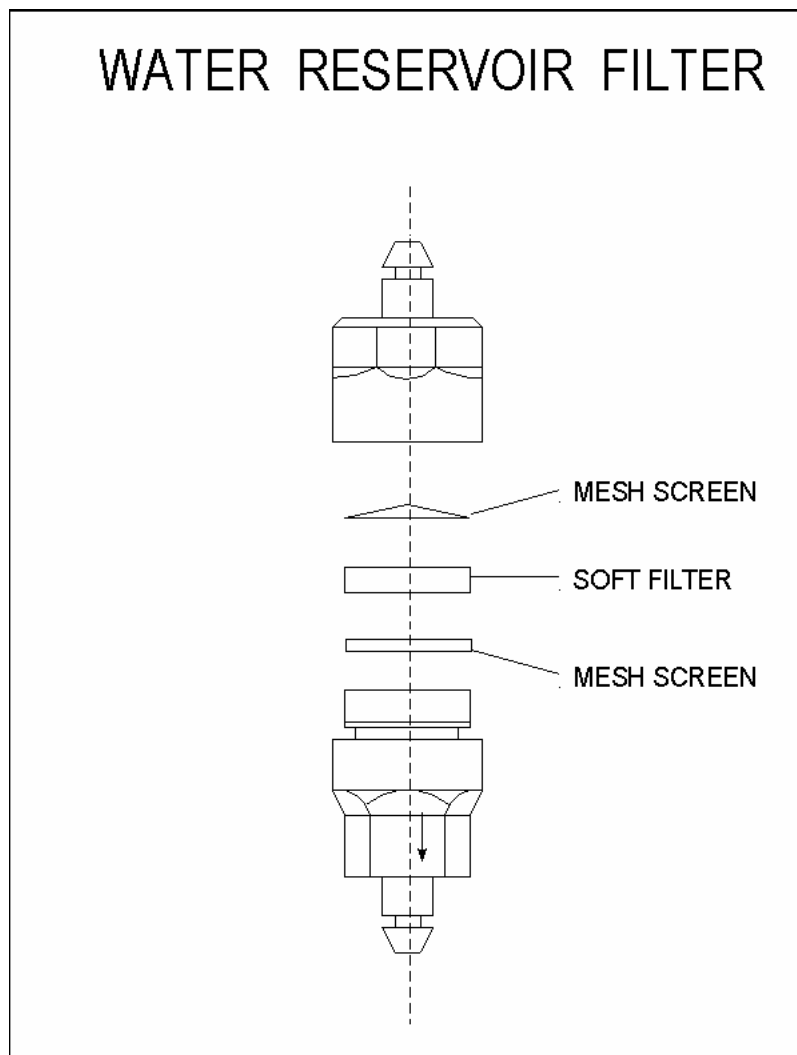
### CHAMBER Y-STRAINER



### 6.11.5 Pump Strainer

Units with Microprocessors that have a software version number containing the letters **WP** will have a Pump Strainer installed to protect the Water Pump.

- ◆ Remove the Outer Cabinet.
- ◆ Drain the Water Reservoir.
- ◆ Unscrew the hose connectors from either side of the Pump Strainer. The Pump Strainer itself will unscrew.
- ◆ Remove the two metal screens and the soft fiber filter.
- ◆ Clean the screens and discard the soft fiber filter (it is not needed and has been found to cause a blockage that prevents the flow of water).
- ◆ Reinstall the screens into the strainer.
- ◆ Screw the strainer back together.
- ◆ Screw the hose connectors back onto the strainer.



## 7 Troubleshooting

### 7.1 Power on Problem

#### 7.1.1 Unit does not turn on

- ◆ Check that the green Start Button (located below the front panel) is in the ON Position.
- ◆ Check that the Circuit Breaker is in the ON position, (not all units have circuit breakers).
  - If the circuit breaker will not remain in the on position, unplug the unit and try the Circuit Breaker again.
  - If it refuses to stay on when unplugged, change it.
  - If it only stays on with the unit unplugged, continue checking the systems in order to discover the location of the short circuit. Otherwise see the section on Circuit Breakers [see sec. 7.8].
- ◆ Check the condition of the Fuses and Fuse Holder with an ohmmeter (not all units have fuses) [see sec. 7.8].
- ◆ Reset the Cut-Out Thermostat.
  - If the Chamber is hot the Cut-Out Thermostat may not reset until the chamber cools.
  - The Cut-Out Thermostat may need to be reset by using the point of a pencil or pen to push the button all the way in.
  - If the Cut-Out Thermostat will not reset, it may need to be replaced [see sec. 7.26].
- ◆ Check that the correct voltage is coming from the wall outlet.
  - The proper voltage range for 110 volt machines is between 110 and 125 volts.
  - The proper voltage range for 220 volt machines is between 220 and 235 volts.
- ◆ Check for a damaged line cord.

#### Remove the outer cabinet,

- ◆ Using the schematics in section 9.
- ◆ Check that the line voltage appears across the output side of the circuit breaker or fuses. If the correct voltage is not present, see the section on circuit breakers and fuses [see sec 7.8].
- ◆ Remove **both** wires from the terminals of the Cut-Out Thermostat and check for continuity with an ohmmeter.
  - If there is no continuity, reset the Cut-Out Thermostat.
  - If the Chamber has cooled and the Cut-Out Thermostat cannot be reset, replace it [see sec. 10.2].
- ◆ If continuity is present, reinstall both wires on the Cut-Out Thermostat.

- ◆ If the unit still does not turn on, disconnect the Molex connector at the Electronic Box. For models with T93 Control Proms, check across pins 1 and 2 on the circuit breaker or fused side of the Molex connector for line voltage. If the unit has a T97 Control Prom, check across pins 1 and 5 for the line voltage [see sec. 9.10].
  - If voltage is not present, recheck from “Remove the cover” above. Look for a loose wire connector or broken wire.
  - If voltage is present, reconnect the Molex connector and continue.
- ◆ Check that voltage is present across the On/Off switch.
- ◆ Check that line voltage is present across the input side of the Power Supply [see sec. 9.11].
- ◆ Voltage should be continuous from the Molex connector **to** the On/Off switch and **through** the On/Off switch **to** the Power Supply.
- ◆ If line voltage is not present on the input side of the Power Supply, it will be necessary to disconnect the wires at the Power Supply and again check across those wires for the line voltage.
- ◆ If voltage is not present across the wire ends, start again at the top of this section and continue until a break in the circuit is found.
- ◆ If line voltage is seen across the ends of the wires, but not when they are connected to the power supply, replace the power supply [see sec. 10.5].
- ◆ If the line voltage is present on the input side of the Power Supply, check that the output side of the Power Supply is producing +5 volts DC between TP17 and TP1 and +12 volts DC between TP15 and TP1.
- ◆ If output voltages are not seen, see the section on Power Supply [see sec. 7.19].
- ◆ If there is output power from the Power Supply but the unit will not turn on, unplug the unit from the wall outlet, unplug all cables inside and outside the electronic box. Replug **only** the cables going into and out of the Power Supply, the power cable going to the Ajunc board, the Molex connector passing through the Electronic Box and the flat cable connecting the Ajunc board and the Digital Predg board, making sure each connector has made a good solid connection and all the pins on the connectors are in good condition. Turn the unit back on.

**DO NOT PLUG OR UNPLUG CABLES WITH THE UNIT  
TURNED ON**

- ◆ If the unit turns on, turn off the unit and one at a time reconnect the remaining cables. Turn the power on after each cable is connected to verify that the unit still turns on.
- ◆ If any cable causes the unit not to turn on, that cable should be left off until the procedure is finished. That cable or the device connected to that cable should be inspected for a defect or a short circuit.
- ◆ If the unit does not turn on, replace the Digital Predg board and the Flat Cable that connects it to the Ajunc board.

### 7.1.2 Unit loses power during operation

- ◆ Check for proper voltage coming from the wall outlet.
  - The proper voltage range for 110 volt machines is between 110 and 125 volts.
  - The proper voltage range for 220 volt machines is between 220 and 235 volts.
- ◆ Check for damaged line cord.
- ◆ Check that the Start Button (located below the front panel) is in the ON Position.
- ◆ Check if the Cut-Out Thermostat has been activated; if so; see the section on the Cut-Out Thermostat [see sec. 7.26].
- ◆ Check if the Circuit Breaker or Fuses are being tripped, if so, see the section on the Circuit Breaker and Fuse problems [see sec. 7.8].
- ◆ Check for a loose or broken line voltage connection inside the unit. Refer to the procedure in sec. 7.1.1 “Remove the cover” also see schematics in sec. 9.10.
- ◆ If all the connections appear good, it is possible that the loss of power is heat related.
  - Make sure the fan is working properly and is not obstructed.
  - Remove any dust buildup on the circuit boards and fan using a vacuum cleaner. After vacuuming and with the unit turned off, blow out the electronic box with compressed air.
- ◆ If the problem persists, operate the unit until failure and apply a product like **Freez-it** or **MicroFreez** to one board at a time, instantly cooling down the components on the Digital Predg board, Ajunc board and Power Supply. If one of these boards has a heat related problem causing the system to crash, cooling them down should temporarily relieve the problem. Whichever board responds to the cooling, that is the board with the problem and should be replaced.

## 7.2 Heat up Problem

### 7.2.1 Unit turns on but produces no heat or insufficient heat

- ◆ Check for proper voltage at the wall outlet.
- ◆ If the unit is not getting the proper voltage from the wall outlet, this low voltage will delay or prevent the production of any heat.
  - The proper voltage range for 110 volt machines is between 110 and 125 volts.
  - The proper voltage range for 220 volt machines is between 220 and 235 volts.

### Remove the outer cabinet

- ◆ With the unit unplugged, check for loose or broken wire connections at the Heating Elements.
- ◆ With the unit unplugged, take an Ohm reading at the Heating Elements and compare the reading to Table 9.1 “Ohm & Amp Readings”. For instructions on how to properly check the Heating Elements [see sec. 8.2].
- ◆ With the unit unplugged, remove the wires between terminals 1 and 2 of the Heat SSR. Check for an open between terminals 1 and 2 with an ohmmeter. Be sure to reverse the meter leads and check in the opposite direction also. Repeat the procedure for terminals 3 and 4. If an open is found, replace the Heat SSR [see sec. 10.8].
- ◆ Reconnect the wires to the Heat SSR, plug the unit in and turn it on, making sure there is sufficient water in the reservoir and that the door is tightly closed. Select a sterilization program, set the temperature for 273°F (134°C) and press Start on the front keypad. The unit should begin to heat up. The Heating Elements should come on and stay on until the pressure reaches approx. 25 psi. At this point, the heaters should be alternating on and off for the duration of the cycle. Verify that the heaters are getting line voltage across the terminals and drawing the proper current. Refer to Table 9.1 for the proper amperages for each model machine. For more detailed instruction on testing the Heating Elements [see sec. 8.2].
- ◆ If the Heating Elements are not receiving the correct voltage or cycling properly:
  - While the unit is running, check the control signal between TP12 to TP1 on the Ajunc board with a voltmeter.
  - Check for a DC signal between 0 and 1 volt when the unit is in the heat ON mode and between 3.5 and 5 volt DC when the heaters are in the OFF mode.
  - If these voltages are not correct, there is a Control Problem [see sec. 7.20].

- ◆ If the control signal is correct at the test point, check if the correct signal is at the Heat SSR.
  - A reading across terminals 3 and 4 should show 3.5 to 5 volts DC for the Heat SSR to be turned on.
  - A reading of 0 to 1 volt if it should be turned off [see sec. 8.1].
- ◆ For units with control proms earlier than T93N3, check that the Temperature Safety Thermostat is not opening at the wrong Temperature. For more information [see sec. 8.8].
- ◆ Check that line voltage is present at terminals 1 & 2 on the Heat SSR [see sec. 8.1].
- ◆ Replace the Heat SSR [see sec. 10.8].

### 7.2.2 Heat does not turn off

- ◆ Check that the preset temperature is not set any higher than 273°F (134°C) [see sec. 5.3].
- ◆ With the unit unplugged, check the Heating Elements for a ground short.
  - Take an ohm reading between the Heating Element terminals and the chassis [see sec. 8.2].
- ◆ With the unit unplugged, remove the wires from the Heat SSR and check for a short circuit between terminals 3 & 4, 1 & 2, 3 & 1, 4 & 2, 3 & 2, and 4 & 1. Make sure there are no direct shorts. If a direct short is found in the Heat SSR, replace the SSR [see sec. 10.8].
- ◆ Reconnect the wires to the Heat SSR and with the unit running a sterilization cycle, check between TP12 to TP1 on the Ajunc board with a volt meter for a DC signal between 0 and 1 volt when the unit is in the heat ON mode and between 3.5 and 5 volt DC when the heaters are in the OFF mode. If these voltages are not correct, there is a Control Problem [see sec. 7.20].
- ◆ If the control signal is correct at the test point, check if the signal is at the Heat SSR. A reading across terminals 3 and 4 should show 3.5 to 5 volts DC for the Heat SSR to be turned on and 0 to 1 volt if it should be off [see sec. 8.1].
- ◆ Replace the Heat SSR.

### 7.2.3 Low Heat message is displayed

**Low Heat** - Refers to the temperature in the Chamber **before** sterilization has begun.

This message is displayed if the programmed sterilization temperature is not reached within 50 minutes of the start of the instrument cycle or 80 minutes for the liquid cycle.

The possible causes are:

- a. Clogged Air Jet [see sec. 6.5].



- b. Very low voltage delaying heat up.
- c. Bad Heating Elements or heater connection [see sec. 8.2].
- d. Temperature Safety Thermostat opening prematurely, turning off Heating Elements - only on units with control proms earlier than T93N3 [see sec. 7.7].
- e. Air Outlet Valve stuck closed [see sec. 7.17].

## 7.3 Pressure Problem

### 7.3.1 Unit heats but will not build or maintain pressure

- ◆ The unit is not getting the proper voltage from the wall outlet. A low voltage will delay or prevent the buildup of pressure.
  - The proper voltage range for 110 volt machines is between 110 and 125 volts.
  - The proper voltage range for 220 volt machines is between 220 and 235 volts.
- ◆ The Water Sensing Electrode may be dirty [see sec. 6.6].
- ◆ The Chamber Strainer at the rear of the autoclave may be clogged [see sec. 6.11].
- ◆ The unit is not filling with the proper amount of water [see sec. 7.15].
- ◆ The Door is not fully closed and the Door Gasket is leaking [see sec. 7.14].
- ◆ The Door Bellows is leaking [see sec. 7.16].
- ◆ The Air Jet is leaking excessively [see sec. 7.16].
- ◆ The Safety Valve is leaking [see sec. 7.16].
- ◆ The items being sterilized are absorbing all the available steam (i.e. cloth towels or gowns).

### Remove the outer cabinet

- ◆ With the unit unplugged, take an ohm reading at the Heating Elements and compare the reading to Table 9.1 “Ohm & Amp Readings”. For instructions on how to properly check the Heating Elements [see sec. 8.2].
- ◆ Check that all valves are closing properly and not leaking due to problems with the plunger or debris lodged in the valve [see sec. 6.4].
  - Fill Valve
  - Exhaust Valve
  - Air Outlet Valve
  - Dry Valve (only on EA, EKA, EZ or EZ10k units)
- ◆ Check if any fittings have come loose or are broken and are leaking.
- ◆ Plug the unit in and turn it on, make sure there is sufficient water in the reservoir and that the door is tightly closed. Select a sterilization program, set the temperature for 273 °F (134 °C) and press Start on the front keypad. The unit should fill and begin to heat up. The heating elements should come on and stay on until the pressure reaches approx. 25 psi. At this point, the heaters should alternate on and off for the duration of the cycle. Verify that the heaters are getting line voltage across the terminals. Also verify that the heaters are cycling on and off properly by either monitoring the line voltage across the element terminals or amperage on the wires going to the elements. Refer to

Table 9.1 for the proper amperages for each model machine. For more detailed instructions on testing the Heating Elements [see sec. 8.2].

- ◆ If the Heating Elements are not receiving the proper voltage or cycling properly:
  - Check for any loose or broken wires.
  - Check the Temperature Safety Thermostat on units with control proms earlier than T93N3 [see sec. 8.8].
  - Check the Heat SSR and the control circuitry [see sec. 8.1].
  - Check if the Chamber has become porous or corroded and is leaking on to the Heaters.

### **7.3.2 Unit heats but pressure reading is inaccurate**

- ◆ Check for a loose Pressure Transducer connection going into the back of the Ajunc board.
- ◆ Check for a blockage in the copper tubing and silicone tubing going to the Pressure Transducer.
- ◆ Turn off the power. Disconnect and reconnect all cables and connectors inside and outside the Electronic Box, making sure that there are no bent or broken pins and all connections are solid.
- ◆ Recalibrate the Pressure Transducer [see sec. 8.5].
- ◆ Replace the Pressure Transducer and calibrate [see sec. 10.4].
- ◆ Replace the Ajunc Board and calibrate [see sec. 10.18].
- ◆ Follow the instructions regarding Control Problems [see sec. 7.20].

### **7.3.3 Pressure does not stop building**

- ◆ Sterilization temperature has been set above 273°F [see sec. 5.3].
- ◆ Heating Elements are not centered or tightened properly [see sec. 10.1].
- ◆ Heating Elements remaining on instead of cycling on and off [see sec. 7.2].
- ◆ Turn off the power. Disconnect and reconnect all cables and connectors inside and outside the Electronic Box, making sure that there are no bent or broken pins and all connections are solid.
- ◆ Verify that the pressure and temperature readings are correct by using a mechanical pressure gauge and an independent thermometer [see sec. 8.11].
- ◆ If the displayed pressure is not accurate, recalibrate the Pressure Sensor [see sec. 8.5].
- ◆ If the displayed temperature is not accurate, recalibrate the Temperature Sensor [see sec. 8.4].

### 7.3.4 Low Pressure message is displayed

- Low Pressure** - Refers to pressure in the Chamber **after** the sterilization temperature has been reached. If the Chamber pressure drops 4 psi below the pressure required for sterilization, the cycle will abort.

**Possible causes:**

1. Insufficient water in the Chamber [see sec. 7.15].
2. Water leaking out of the Chamber [see sec. 7.16].
3. The sterilization phase of the cycle has been set for too long a period of time, allowing the Chamber water to boil away, and the Chamber to run dry [see sec. 5.3].
4. Heating Elements are not cycling on and off properly.
  - a. Problem with the Heat SSR [see sec. 8.1].
  - b. Problem with the control circuit [see sec. 7.2].
5. Bad Heating Elements -- not producing enough wattage [see sec. 8.2].
6. Temperature Safety Thermostat opening prematurely, turning off Heating Elements --only on units with control proms earlier than T93N3 [see sec. 8.8].
7. Bad Pressure Transducer [see sec. 8.5].

### 7.3.5 High Pressure message is displayed

- High Pressure** - Refers to Chamber pressure **after** sterilization temperature has been reached. If the Chamber pressure rises 10 psi above the pressure required for sterilization the cycle will abort.

**Possible causes:**

1. Sterilization temperature has been set above 273°F [see sec. 5.3].
2. Heating Elements are not centered or tightened properly [see sec. 10.1].
3. Heating Elements remaining on instead of cycling on and off [see sec. 7.2].
4. Pressure or Temperature calibrations are incorrect.
  - a. Turn off the power.
  - b. Disconnect and reconnect all cables and connectors inside and outside the Electronic Box, making sure that there are no bent or broken pins and all connections are solid.
  - c. Verify that the pressure and temperature readings are correct by using a mechanical pressure gauge and an independent thermometer.
  - d. If the displayed pressure is not accurate, recalibrate the Pressure Sensor [see sec. 8.5]
  - e. If the displayed temperature is not accurate, recalibrate the Temperature Sensor [see sec. 8.4].

## 7.4 Temperature Problem

There are two Temperature Sensors currently in use.

- Systems with Ajunc 2 boards will use an LM34 or LM34 replacement.
- Systems with Ajunc 3 boards will use a PT100.

### 7.4.1 Temperature rises but never reaches preset sterilization temperature

- ◆ If the unit is **not** able to reach and maintain the proper **pressure** that corresponds with the preset temperature (i.e., 273°F = 30 psi), check Pressure Problems in sec. 7.3.
- ◆ If the unit **can** maintain the proper pressure, clean or replace the Air Jet [see sec. 10.9].

### 7.4.2 Temperature rises above maximum sterilization temperature

- ◆ Check that the preset temperature is not set any higher than 273°F (134°C) [see sec. 5.3].
- ◆ Check if the Heating Elements are staying on continuously, if so; see Heat up problems [see sec. 7.2].
- ◆ Heating Elements are not centered or tightened properly [see sec. 10.1].
- ◆ Check that the pressure in the unit is not dropping. Dropping pressure would indicate a loss of water in the Chamber [see sec. 7.16].
- ◆ Turn off the power. Disconnect and reconnect all cables and connectors inside and outside the Electronic Box, making sure that there are no bent or broken pins and all connections are solid.
- ◆ Verify that the pressure and temperature readings are correct by using a mechanical pressure gage and an independent thermometer [see sec. 8.11].
- ◆ If the displayed pressure is not accurate, recalibrate the Pressure Sensor [see sec. 8.5].
- ◆ If the displayed temperature is not accurate, recalibrate the Temperature Sensor [see sec. 8.4].

### 7.4.3 Unit heats and builds pressure but temperature reading is inaccurate

- ◆ If the temperature display reads 36°F, that indicates a bad sensor, replace the Temperature Sensor [see sec. 10.3] and recalibrate.
- ◆ Check for a loose connection. Turn off the power, disconnect and reconnect all cables and connectors inside and outside the Electronic Box, making sure that there are no bent or broken pins and all connections are solid.
- ◆ Perform the Temperature Calibration [see sec, 8.4].

- ◆ If the sensor will not calibrate properly and the unit has an Ajunc 2 Board, replace the LM34 Temperature Sensor [see sec. 10.3] and recalibrate.
  - If this is not successful, replace the Digital Predg Board [see sec. 10.19] and recalibrate.
- ◆ If the sensor will not calibrate properly and the unit has an Ajunc 3 Board, replace the Ajunc 3 board [see sec. 10.18] and recalibrate.
  - If this does not correct the problem, replace the PT100 Temperature Sensor [see sec. 10.3] and recalibrate.

#### 7.4.4 Low Temperature message is displayed

**Low Temperature** - Refers to temperature in the Chamber **after** the sterilization temperature has been reached. If the temperature drops 4.5°F below the required sterilization temperature, the cycle will abort.

**Possible causes:**

1. Temperature Sensor is defective and should be replaced [see sec. 10.3].
2. Bad Heating Elements - not producing enough wattage [see sec. 8.2].
3. Heating Elements not cycling on and off properly [see sec. 7.2].
4. Insufficient water in the Chamber [see sec. 7.15].
5. Water leaking out of the Chamber [see sec. 7.16].
6. The sterilization phase of the cycle has been set for too long a period of time, allowing the Chamber water to boil away and the Chamber to run dry [see sec. 5.3].
7. Temperature Safety Thermostat opening prematurely, turning off the Heating Elements, only on units with control proms earlier than T93N3 [see sec. 8.8].

#### 7.4.5 High Temperature message is displayed

**High Temperature** - Refers to temperature in the Chamber **after** the sterilization temperature has been reached. If temperature rises 9° F above the required sterilization temperature the cycle will be aborted.

This message can **ALSO** indicate a bad Temperature Sensor – the message will display anytime during the heat up phase. If this happens, replace the Temperature Sensor [see sec. 10.3].

**Possible causes:**

1. Insufficient water in the Chamber [see sec. 7.15].
2. Water leaking out of the Chamber [see sec. 7.16].
3. The sterilization phase of the cycle has been set for too long a period of time, allowing the Chamber water to boil away, and the Chamber to run dry [see sec. 5.3].
4. Heating Elements are not centered or tightened properly [see sec. 10.1].
5. Heating Elements remaining on instead of cycling on and off [see sec. 7.2].
6. Pressure or Temperature calibrations are incorrect.
  - a. Turn off the power.
  - b. Disconnect and reconnect all cables and connectors inside and outside the Electronic Box, making sure that there are no bent or broken pins and all connections are solid.
  - c. Use a mechanical pressure gauge to verify and recalibrate the pressure [see sec. 8.5].
  - d. Use an electronic thermometer to verify temperature. Recalibrate as needed [see sec. 8.4].

## **7.5 Keypad Problem**

### **7.5.1 Keypad does not respond**

- ◆ Check for +12 and +5 volts DC on TP17 and TP15, if voltages are not present [see sec. 7.19].
- ◆ Check that the number 3 dip switch on the Digital Predg Board is in the down or off position. Cycle the unit off and on, if a change was made. For an explanation of the dip switches [see sec. 8.10].
- ◆ Check that the green ground wire connecting the Digital Predg Board and the Electronic Box is secure at both ends and connected in the middle.
- ◆ Turn off the power. Disconnect the small flat cable going from the Keypad to the Digital Predg Board; inspect the connector for bent pins and reconnect, making sure the connection is solid.
- ◆ Turn off the power. Disconnect and reconnect the flat cable going from the Ajunc Board to the Digital Predg Board, being sure to inspect all connectors for bent or broken pins.
- ◆ If a Printer is installed, turn off the power and disconnect the Printer Cable at the Digital Predg Board, turn the power back on and test the Keypad. If there is no change, turn off the power and reconnect the Printer Cable.
- ◆ Replace the Keypad [see sec. 10.19].
- ◆ Replace the Digital Predg board [see sec. 10.19].

### **7.5.2 Keypad responds but without beeping**

Replace the Digital Predg board [see sec. 10.19].

### **7.5.3 Keypad beeps continuously**

- ◆ Battery Backup bad or missing from board.
- ◆ Keypad shorted.
- ◆ Digital Predg Board defective.
- ◆ Microprocessor not in board.



## 7.6 Overheating Problem

### 7.6.1 Damage occurs inside the chamber during the Sterilization cycle

- ◆ Items are lying up against the Chamber wall. During sterilization the Chamber wall becomes very hot, much hotter than the steam temperature. A hot Chamber wall can damage anything that touches it [see sec. 5.1].
- ◆ The Chamber is not pitched properly [see sec. 2.4].
- ◆ The unit is not filling with the correct amount of water.
  - Clean the Water Sensor [see sec. 6.6].
  - Clean the Chamber Strainer on units manufactured after 2/2000 [see sec. 6.11].
  - Clean the Pump Strainer on units manufactured after 2/2000 [see sec. 6.11].
  - Reset the automatic water fill [see sec. 7.15].
- ◆ The Water Sensor is being shorted by something metal (rack, trays or instruments), a damp cloth or bag; clear any debris away from the sensor [see sec. 7.15].
- ◆ The amount of sterile time is set too high [see sec. 5.3].
- ◆ The sterilization temperature is set too high [see sec. 5.3].
- ◆ The items being sterilized are of an absorbent material and soaking up all the available steam.
- ◆ The unit has a steam or water leak [see sec. 7.16].
- ◆ The Air Outlet Valve is stuck.
  - When the valve is stuck closed the Chamber may not fill with the proper amount of water [see sec. 7.17].
  - When the valve is stuck open, steam will escape too rapidly and the Chamber will run dry [see sec. 7.17].
- ◆ The Heating Elements are shorted, allowing them to run continuously [see sec. 8.2].
- ◆ The Heat SSR is defective, allowing the Heating Elements to run continuously [see sec 8.1].
- ◆ The Temperature Safety Thermostat and / or Cut-Out Thermostat are not functioning properly. The probes may be loose or mispositioned or the tubes may be kinked [see sec. 7.7, sec 7.26].

### **7.6.2 Damage occurs inside the chamber during the Drying cycle**

- ◆ Voltage from the wall outlet is too high.
  - The higher the voltage the more heat will be produced.
  - Higher heat can damage items during the dry cycle.
  - The proper voltage range for 110 volt machines is between 110 and 125 volts.
  - The proper voltage range for 220 volt machines is between 220 and 235 volts.
- ◆ Items are lying up against the Chamber wall. The Chamber wall is much hotter than the temperature of the air inside the Chamber. A hot Chamber wall can damage anything that touches it [see sec. 5.1].
- ◆ The Heating Elements are shorted allowing them to run continuously [see sec. 8.2].
- ◆ The Heat SSR is defective, allowing the Heating Elements to run continuously [see sec. 8.1].
- ◆ The Temperature Safety Thermostat and/or Cut-Out Thermostat are not functioning properly. The probes may be loose or mispositioned or the tubes may be kinked [see sec 7.7, sec. 7.26].

## 7.7 Temperature Safety Thermostat Problems

**Note: The Temperature Safety Thermostat is factory calibrated. It should not be adjusted in the field.**

### 7.7.1 There is no continuity across the Temperature Safety Thermostat

- ◆ To correctly check continuity, unplug the unit and remove the two power wires from the Temperature Safety Thermostat, use an ohmmeter to check across the terminals for continuity.
- ◆ Make sure the Chamber has cooled. If the Chamber remains hot the Temperature Safety Thermostat will not automatically reset.
- ◆ If the Temperature Safety Thermostat will not automatically reset and restore continuity across its terminals, replace the Temperature Safety Thermostat [see sec. 10.2].

### 7.7.2 Temperature Safety Thermostat does not turn off heaters during Dry Cycle

- ◆ The sensing probe should be installed in the lower channel of the rear-most Heating Element [see sec. 10.2].
- ◆ The sensing probe must have a tight fit [see sec. 10.2]. The tubing connected to the probe must not be kinked in any way [see sec. 10.2].
- ◆ If the Temperature Safety Thermostat is hard wired (as on units with control proms earlier than T93N3), replace the Temperature Safety Thermostat [see sec. 10.2].
- ◆ If the Temperature Safety Thermostat is connected to the microprocessor (as on units with control proms later than and including T93N3), it will be necessary to run the machine in order to perform the next test. Select the **Dry Cycle** and start the unit running. When the autoclave has started running, remove the thin green wire that connects the Temperature Safety Thermostat to the microprocessor. The unit should immediately turn off power to the Heating Elements. If this does **not** happen, this would indicate a problem with the Heat SSR [see sec. 8.1] or a ground short in the Heating Elements [see sec. 8.2] or a control problem [see sec. 7.20].
- ◆ If the unit does abort and remove power from the Heating Elements (verify this by checking at the Heating Elements for either voltage or amperage), replace the Temperature Safety Thermostat [see sec. 10.2].

## 7.8 Circuit Breaker or Fuse Problem

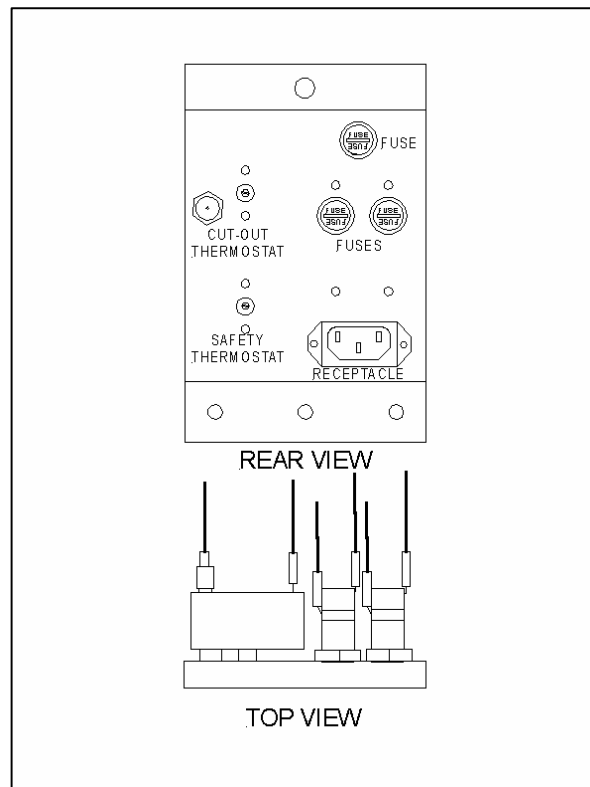
### 7.8.1 There is no output from the circuit breaker or fuse

- ◆ If this is not a main fuse problem, see the proper section below:
  - Problems with the Power Supply Fuse [see sec. 7.19].
  - Problems with the Dry Pump Fuse [see sec. 7.9].
  - Problems with the Water Pump Fuse [see sec. 7.27].
- ◆ Check for correct voltage at wall outlet.
  - The proper voltage range for 110 volt machines is between 110 and 125 volts.
  - The proper voltage range for 220 volt machines is between 220 and 235 volts.
- ◆ Check for a bad Line Cord.
- ◆ Check for a faulty power receptacle at the back of the autoclave.
- ◆ Check for voltage on the input side of the Circuit Breaker or Fuse.
  
- ◆ If this is a fused unit, check that the Fuse is not blown. A visual inspection may not show a blown Fuse. It is always recommended that the Fuse be checked with an ohmmeter.
- ◆ Check the Fuse Holder for continuity both in and out of the holder.
- ◆ Replace the Fuse Holder if necessary.
  
- ◆ If this unit has a Circuit Breaker, check that the Circuit Breaker is in the on position.
- ◆ If the unit has a Circuit Breaker and all the above are okay, replace the Circuit Breaker.

### 7.8.2 The circuit breaker or fuse gets hot

- ◆ If this is not a main fuse problem, see the proper section below:
  - Problems with the Power Supply fuse [see sec. 7.19].
  - Problems with the Dry Pump Fuse [see sec. 7.9].
  - Problems with the Water Pump Fuse [see sec. 7.27].
- ◆ Check that the voltage is in the correct range for that unit.
  - The proper voltage range for 110 volt machines is between 110 and 125 volts.
  - The proper voltage range for 220 volt machines is between 220 and 235 volts.
- ◆ Check for a bad plug on the Line Cord.
- ◆ Check for a faulty receptacle on the autoclave or on the wall.
- ◆ Check for loose wire connections on the input and output side of the Circuit Breaker or Fuse. Loose connectors will cause arcing that will cause that device to get hot.

- ◆ Check that the amperage draw of the machine is within the specification for that unit (see table 9.1).
  - If the amperage is higher than the spec allows, check the resistance across the Heating Elements.
  - Also make sure to check from the heaters to ground [see sec. 8.2].
- ◆ If the unit has fuses, check for loose internal connections on the Fuse Holder.
- ◆ If the unit has a Circuit Breaker and all the above are okay, replace the Circuit Breaker. It is possible for the Circuit Breaker to weaken over time.



**Mounting Plate with Fuses**

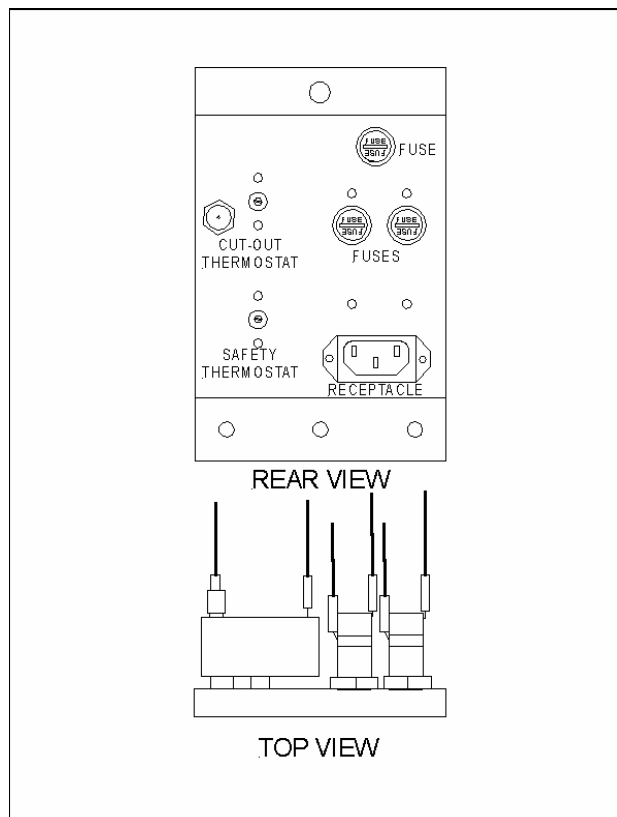
### **7.8.3 Circuit breaker or fuse trips while unit is running**

- ◆ If this is not a main fuse problem, see the proper section below:
  - Problems with the Power Supply Fuse [see sec. 7.19].
  - Problems with the Dry Pump Fuse [see sec. 7.9].
  - Problems with the Water Pump Fuse [see sec. 7.27].
- ◆ Check that the voltage is in the correct range for that unit.
  - The proper voltage range for 110 volt machines is between 110 and 125 volts.
  - The proper voltage range for 220 volt machines is between 220 and 235 volts.

- ◆ Check the resistance of the Heating Elements, of particular interest would be a reading to ground. Check when the unit is hot but not plugged in [see sec. 8.2].
- ◆ Check for damaged or shorted wires throughout the unit (see schematics in sec. 9.10).

#### 7.8.4 Circuit breaker or fuse trips each time unit is turned on

- ◆ If this is not a main fuse problem, see the proper section below:
  - Problems with the Power Supply Fuse [see sec. 7.19].
  - Problems with the Dry Pump Fuse [see sec. 7.9].
  - Problems with the Water Pump Fuse [see sec. 7.27].
- ◆ Check that the voltage is in the correct range for that unit.
  - The proper voltage range for 110 volt machines is between 110 and 125 volts.
  - The proper voltage range for 220 volt machines is between 220 and 235 volts.
- ◆ Check for a ground short at the Heating Elements, [see sec. 8.2].
- ◆ Check for damaged or shorted wires throughout the unit (see schematics in sec. 9.10).



**Mounting Plate with Circuit Breaker**

### **7.8.5 Circuit breaker or fuse trips as soon as unit is plugged in**

- ◆ If this is not a main fuse problem, see the proper section below:
  - Problems with the Power Supply Fuse [see sec. 7.19].
  - Problems with the Dry Pump Fuse [see sec. 7.9].
  - Problems with the Water Pump Fuse [see sec. 7.27].
- ◆ Make sure this problem occurs when the unit's main switch is not turned on.
- ◆ Unplug the unit.
- ◆ Disconnect the wires coming out from the Circuit Breaker or Fuse.
- ◆ Plug the unit back in.
  - If the problem persists, replace the Fuse Holder or Circuit Breaker.
  - If the problem goes away:
    - Check for a ground short at the Heating Elements, [see sec. 8.2].
    - Check if the Thermostat capillary tubes are shorting the autoclave receptacle.
    - Check for damaged or shorted wires throughout the unit (see schematics in sec. 9.10).

## 7.9 Dry Pump Problem

**The Dry Pump is present only on EA, EKA, EZ and EZ10k machines**

### 7.9.1 Pump does not turn on

- ❖ On units with a T96DN1 microprocessor, the Dry Pump will come on at the start of any dry cycle but only if the Chamber door is fully closed. The pump will turn off as soon as the door is opened and will **not** come back on if the door is closed again. To restart the Dry Pump, first press the Stop Button and abort the current Dry Cycle. Now select the Dry Only cycle, making sure that the amount of drying time needed is set correctly, close and tighten the door and press Start.
- ❖ On units with a T97N6, the Dry Pump will come on at the beginning of any dry cycle regardless of whether the door is open or closed and will stay on even if the door is opened during the dry cycle.
  
- ◆ Check the Dry Pump Fuse with an ohmmeter and if needed, replace with a 1.2 amp fuse. The Dry Pump Fuse is located above the two line voltage Fuses or the Circuit Breaker at the back of the autoclave.
- ◆ Check for a pinched wire or other open in the power leads going from the Dry Fuse to the Dry Pump.
- ◆ Turn the power off; remove the wires connected to terminals 1 and 2 on the output side of the Dry SSR (Solid State Relay). The Dry SSR is located inside the Electronic Box. Connect these two wires together and turn the power back on.
  - If the pump runs, the problem is with either the Dry SSR or the control circuit.
  - If the Dry Pump does not run, the problem is with the pump and it should be replaced [see sec. 10.14].
- ◆ Check if the Dry SSR is being told to turn on or off. With a DVM read between TP20 and TP1, a 3.5 to 5 volt DC signal tells the Dry SSR to turn off and 0 to 1 volts tells it to turn on, (if the unit has an Ajunc 2 board this check will be made between TP18 and TP1). An incorrect signal would indicate a problem with the control circuit [see sec. 7.20].
- ◆ If the control signal is correct at the test point, check if the signal is at the Dry SSR. Terminals 3 and 4 are located on the input side of the SSR and are connected to JP16 on the Ajunc 3 board or JP9 on the Ajunc 2 board. A reading across terminals 3 and 4 should show 10 to 12 volts DC for the Dry SSR to be turned on and 0 to 1 volt if it should be off [see sec. 8.1].
- ◆ If the control signal is not correct on the input side of the Dry SSR, the problem is with the Ajunc board and it should be replaced [see sec. 10.18].



### **7.9.2 Pump does not turn off**

At the end of any dry cycle, the Dry Pump will stay on until the door has been opened, even if the Stop Button has been pressed and the cycle aborted. If the door remains closed, the Dry Pump will continue to run for 2 hours to insure the sterilized items have properly dried and cooled before shutting itself off.

- ◆ Check if the Dry SSR is being told to turn off. With a DVM read between TP20 and TP1, a 3.5 to 5 volt DC signal tells the Dry SSR to turn off and 0 to 1 volts tells it to turn on. (If the unit has an Ajunc 2 board, this check will be made between TP18 and TP1). An incorrect signal would indicate a problem with the control circuit [see sec. 7.20].
- ◆ If the control signal is correct at the test point, check if the signal is at the Dry SSR. A reading across terminals 3 and 4, on the input side of the SSR, should show 10 to 12 volts DC for the Dry SSR to be turned on and 0 to 1 volt if it should be off [see sec. 8.1].
- ◆ If the control signal is not correct at the Dry SSR, the problem is with the Ajunc board and it should be replaced [see sec. 10.18].

### **7.9.3 Dry pump blows fuse**

- ◆ Check if the Dry Pump fan blade is stuck.
- ◆ Check for a pinched wire or other ground short in the power leads going from the Dry Fuse to the Dry SSR and Dry Pump.
- ◆ Turn off the power and disconnect the wires from terminals 1 & 2 on the Dry SSR. Turn the power back on; if the fuse blows again the problem is with the wiring going to the Dry SSR and it should be repaired. If the fuse does not blow, the problem is with the Dry Pump and it should be replaced [see sec. 10.14].

### **7.9.4 Pump makes noise**

- ◆ Check if the Dry Pump fan blade is hitting anything.
- ◆ Check the pump bearing, if bad replace the Dry Pump.
- ◆ Check if the Dry Pump mounting bracket is loose or broken; if bad, replace the pump bracket.

### **7.9.5 Pump does not pump air**

- ◆ Check if the HEPA Filter is clogged.
  - Remove the HEPA Filter and run the dry cycle.
  - If air is now being pumped, install a new HEPA Filter.
  - Check for suction at the end of the tube the HEPA filter was connected to.

- ◆ Check if the Dry Solenoid is being activated. Place a steel object like a screwdriver on the center post of the Dry Solenoid to detect a magnetic field. If a magnetic field is detected, the solenoid has been turned on. If no magnetic field is detected, [see sec. 8.3].
- ◆ Listen for a click at the Dry Solenoid when the Dry Pump turns on. A click will indicate that the solenoid should be open. If there is no click [see sec. 8.3].
- ◆ Open the Dry Solenoid Valve, remove the plunger and reinstall the housing only. Start a Dry only cycle:
  - If air is pushing through to the Chamber, the problem is with the Plunger.
  - If not, remove the housing. If air is pushing through to the valve base, the problem is in the tubing from the valve base to the Chamber.
  - If the air is not pushing through to the valve base, the problem is with the tubing from the base to the pump or the Dry Pump itself.
  - If there is no suction through the HEPA filter or the tube connected to the HEPA filter, the reed valve inside the pump may be broken.
  - Replace the pump if necessary.

#### **7.9.6 Air flows in the wrong direction**

Reverse the two silicone tubes connected to the Dry Pump.

## 7.10 Drying Problem

### 7.10.1 Instruments or packs are damp or wet

**Note:** Drying is available only in the **Wrapped, Unwrapped** and **Dry Only Cycles**. **Liquid & Glassware Cycles** have no rapid exhaust or drying capability.

- ◆ Drying time may be too short.
- ◆ For **E** and **EK** machines with a full load and the door fully closed, a typical dry time would be between 45–50 minutes. With the door cracked open at the beginning of the dry cycle, the drying time can be reduced to approximately 30 minutes.
- ◆ For **EA, EKA, EZ** and **EZ10k** machines with a full load, a typical dry time would be approximately 20 minutes with the door fully closed. On these models, the door should not be opened during drying.
- ◆ Autoclave may be too heavily loaded.  
**Drying problems can be the result of improper loading of the autoclave.**
- ◆ The recommended loading for any Tuttnauer autoclave is for the instruments to be laid out **one level deep**. It is never recommended that instruments be laid on top of each other. In addition, the total load in the autoclave should not exceed the poundage noted in the following table:

<b>Model</b>	<b>Total Load</b>
1730	6 lbs
2340/EZ9	8 lbs
2540/EZ10/EZ10K	8 lbs
3140 (3545)	11 lbs
3850	13.6 lbs
3870	14 lbs

- ◆ Incorrect loading will impede the drying ability of the autoclave.
- ◆ Tuttnauer makes a pouch rack for sterilizing bagged instruments that will also aid in properly drying the instruments. The pouch rack allows the pouches to stand on edge, as recommended by the pouch manufacturers. Use of the pouch rack automatically provides proper spacing for better sterilization and drying.
- ◆ If a pouch rack is not used, the pouches should be laid on the tray plastic side down. Placing the paper side down will cause the pouch to retain moisture and prolong drying.
- ◆ The voltage coming from the wall outlet may be too low. The lower the voltage, the less heat will be produced, the slower the drying.
  - The proper voltage range for 110 volt machines is between 110 and 125 volts.
  - The proper voltage range for 220 volt machines is between 220 and 235 volts.

- ◆ The Temperature Safety Thermostat may be interrupting power during the drying cycle [see sec. 7.7].
- ◆ The Air Outlet Valve may be clogged or not opening properly which will not allow the Chamber to vent properly [see sec. 6.4, sec. 7.17].
- ◆ The Exhaust Valve may be clogged or not opening properly and will cause water to be left in the bottom of the Chamber at the end of the exhaust phase [see sec. 6.4 and sec. 8.3].
- ◆ The Chamber Strainer may be clogged and will cause water to be left in the bottom of the Chamber at the end of the exhaust phase [see sec. 6.11].
- ◆ The Reservoir may be overfilled and allowing water to siphon back into the Chamber during the Dry Cycle.
- ◆ There may be a pinhole in the body of the Cooling Coil allowing water to siphon back into the Chamber.
- ◆ The open end of the Cooling Coil, in the water Reservoir, may be below the water line. This will result in water flowing back into the Chamber during the Drying Cycle. Reaching into the Reservoir and holding down the body of the coil while pulling up on and stretching the neck can easily correct this.
- ◆ Some machines have a different Cooling Coil that is designed to extend below the water line. In these units a Check Valve is present to prevent water from siphoning back to the chamber. If suck back is occurring during the Dry Cycle or normal cool down, check the Cooling Coil and replace the Check Valve.
- ◆ On EA, EKA, EZ and EZ10k models:
  - The HEPA Filter may be dirty or clogged.
  - The Dry Pump may not be turning on or may be weak [see sec. 7.9].
  - The Dry Solenoid may not be opening [see sec. 6.4 and sec. 8.3].
  - The Fill Tube or Chamber Screen may be clogged interrupting the flow of air into the Chamber.

### **7.10.2 Items are burning or melting**

- ◆ Voltage from the wall outlet is too high. The higher the voltage the more heat will be produced. Higher heat can damage items during the dry cycle.
  - The proper voltage range for 110-volt machines is between 110 and 125 volts.
  - The proper voltage range for 220-volt machines is between 220 and 235 volts.
- ◆ Items are lying up against the Chamber wall. The Chamber wall is much hotter than the temperature of the air inside the Chamber. A hot Chamber wall can damage anything that touches it [see sec. 5.1].

- ◆ The Heating Elements are shorted allowing them to run continuously [see sec. 8.2].
- ◆ The Heat SSR is defective and allowing the Heating Elements to run continuously [see sec. 8.1].
- ◆ The Temperature Safety Thermostat and / or Cut-Out Thermostat are not functioning properly. The probes may be loose or mispositioned or the tubes may be kinked [see sec. 7.7, sec. 7.26].

## 7.11 Sterilizing Problem

### Spore tests are failing or Indicator strips are not turning

- ◆ It is important to first eliminate the possibility of bad spore tests or strip indicators.
- ◆ These items should always be stored in a cool dry location.
- ◆ Never store in a cabinet above the autoclave. This will expose these items to heat and moisture rising from the top of the autoclave. Even though in a closed cabinet above the autoclave these items will still be exposed to heat and moisture and will become unreliable.

### Autoclave may be too heavily loaded

- ◆ Sterilization problems can be the result of improper loading of the autoclave.
- ◆ The recommended loading for any Tuttnauer autoclave is that the instruments be laid out **one level deep**. It is never recommended that instruments be laid on top of each other. In addition, the total load in the autoclave should not exceed the poundage noted in the following table:

<b>Model</b>	<b>Total Load</b>
1730	6 lbs
2340/EZ9	8 lbs
2540/EZ10/EZ10K	8 lbs
3140 (3545)	11 lbs
3850	13 lbs
3870	14 lbs

- ◆ Incorrect loading will impede the sterilization and drying ability of the autoclave.
- ◆ Tuttnauer makes a pouch rack for sterilizing bagged instruments that will also aid in properly drying the instruments. The pouch rack allows the pouches to stand on edge, as recommended by the pouch manufactures. Use of the pouch rack automatically provides proper spacing for better sterilization and drying.
- ◆ If a pouch rack is not used, the pouches should be laid on the tray plastic side down.

### Temperature and Time settings may be incorrect

- ◆ Sterilization problems can be the result of an improper sterilization temperature or time.
- ◆ Tuttnauer autoclaves have been certified to sterilize at 273°F for a period of 3 minutes for unwrapped instruments, or 7 minutes for wrapped instruments.

- ◆ The autoclave can sterilize at other temperatures, however, the lower the sterilization temperature the longer the sterilization time.
- ◆ In all cases, a spore test is your only guarantee of proper sterilization.
- ◆ If adhering to these instructions still results in a failed sterilization cycle, continue to the next step.

### **Checking temperature and pressure**

- ◆ Run a sterilization cycle with a temperature of 273°F (134°C). Check if the unit is able to reach the proper pressure 29 – 30 psi.
- ◆ Check if the autoclave temperature is able to reach 273°F. Different models will take varying amounts of time to reach this temperature:

1730E, 2340E & EA, 2540E & EA, 3140E & EA, EZ9 and EZ10 units will take approx. 20 minutes.

3850E & EA, 3870E & EA units will take approx. 30 minutes.

All EK, EKA and EZ10k units will take approx. 10 minutes.

(These times are approximate and depend on the initial temperature of the Chamber, size and type of load and the incoming voltage).

- ◆ If the unit is able to reach a pressure between 29 and 30 psi, but not able to reach 273°F, clean or replace the Air Jet [see sec. 6.5].
- ◆ If the unit is not able to reach the proper pressure, see sec. 7.3.
- ◆ If the unit reaches temperature and pressure but does not stay at temperature or pressure for the proper length of time, see sec. 7.3 and sec. 7.4.

## 7.12 Fan Problem

### 7.12.1 Fan is not running – Units manufactured before 2/2000

The Fan will come on when the autoclave is turned on. If no cycle is run the Fan will turn off after two hours. Pressing any key on the Keypad will start the Fan again. If not, cycle the unit off then on to reset the Fan. If the Fan still does not turn on, proceed with the following steps.

- ◆ Unplug the Fan, JP5 on the Ajunc 2 or JP15 on the Ajunc 3 and make sure the Fan Blade is free to turn. Remove any dirt from the blade and free the blade from any obstructions.
- ◆ Check between TP13 and TP1 for a 0 to 1 volt DC signal. This is instructing the Fan to turn on; a 10 to 12 volt DC signal tells the Fan to turn off.
- ◆ If the correct signal is present, check that the JP5 connector on the Ajunc 2 Board or the JP15 on the Ajunc 3 Board is plugged in correctly. Unplug and replug in the connector, making sure a good connection is made. Repair the connection if needed.
- ◆ Remove the JP5 connector on the Ajunc 2 board or the JP15 connector on the Ajunc 3 board and check across the JP5 or JP15 terminals on the board for +12 volts DC.
- ◆ If the correct voltage is not present, check across TP15 and TP1 for the +12 volts. If the voltage is not present across TP15 and TP1, check the Power Supply [see sec. 7.19].
- ◆ If the voltage across TP15 and TP1 is correct, replace the Ajunc 2 or Ajunc 3 board [see sec. 10.18].
- ◆ If the correct voltage is present across either JP5 or JP15 and the connection is good, replace the Fan [see sec. 10.21].

### 7.12.2 Fan is not running – Units manufactured after 2/2000

The Fan will come on and stay on as long as the autoclave is turned on. Autoclaves manufactured after 2/2000 have no sleep mode. If the Fan does not turn on, proceed with the following steps.

- ◆ Check for a good connection at JP10. Unplug and replug the connector making sure a good connection is made. Repair the connection if needed.
- ◆ Unplug the Fan, JP10 on the Ajunc 3, and make sure the fan blade is free to turn. Remove any dirt from the blade and free the blade from any obstructions.
- ◆ Remove the JP10 connector and check across the JP10 terminals on the Ajunc 3 board for +12 volts DC.



- ◆ If the correct voltage is not present, check across TP15 and TP1 for the +12 volts. If the voltage is not present across TP15 and TP1, check the Power Supply [see sec. 7.19].
- ◆ If the voltage across TP15 and TP1 is correct, replace the Ajunc 3 board [see sec. 10.18].
- ◆ If the correct voltage is present across JP10 and the connection is good, replace the Fan [see sec. 10.21].

### **7.12.3 Fan makes noise**

- ◆ Check for any foreign objects in the Fan housing.
- ◆ Remove any accumulations of dirt or dust on the Fan.
- ◆ Check if the Fan Blade is rubbing on any part of the housing or mesh screen.
- ◆ Check if the Fan Blade is free spinning.
- ◆ Replace the Fan [see sec. 10.21].

## 7.13 Odor Problem

### 7.13.1 Autoclave gives off an odor while running a sterile cycle

**When installing new Heating Elements, it is common for them to smoke and give off an odor for one or two cycles.**

- ◆ Use only distilled water in the reservoir.
- ◆ Use only those additives manufactured specifically for use in a steam autoclave.
- ◆ Make sure that any cleaning agents have been thoroughly rinsed and flushed out.
- ◆ The last step in cleaning should be to use the Manual Fill Button to run 3 or 4 ounces of clean water from the Reservoir through the fill line and out the Chamber. Also, be sure the Chamber's inside surface has been wiped out.
- ◆ Make sure nothing is touching the inside wall of the autoclave. The inside surface of the Chamber gets much hotter than the steam and can cause paper and plastic to burn or melt.
- ◆ Make sure the Chamber is pitched properly and filling with the proper amount of water [see sec. 2.4].
- ◆ Check for damaged Heating Elements [see sec. 8.2].
- ◆ Check that nothing is lying directly under the Heating Elements, this includes the Insulation Blanket.
- ◆ Check for any Overheating Problem [see sec. 7.6].

### 7.13.2 Autoclave gives off an odor when running a dry cycle

- ◆ Make sure that any cleaning agents have been thoroughly rinsed and flushed out.
- ◆ The last step in cleaning should be to use the Manual Fill Button to run 3 or 4 ounces of clean water from the Reservoir through the fill line and out the Chamber. Also, be sure the Chamber's inside surface has been wiped out.
- ◆ Make sure nothing is touching the inside wall of the autoclave. The inside surface of the Chamber gets much hotter than the steam and can cause paper and plastic to burn or melt.
- ◆ Check for damaged Heating Elements [see sec. 8.2].
- ◆ Check that nothing is lying directly under the Heating Elements, this includes the Insulation Blanket.
- ◆ Check for any Overheating Problem [see sec. 7.6].

### 7.13.3 Autoclave gives off an odor when cleaning with Chamber Brite

If the autoclave has not been cleaned in some time, the first cleaning with **Chamber Brite** can result in an odor. The odor comes from the dirt in the machine that is now being loosened up and cleaned away. The next cleaning should produce very little, if any, odor.

- ◆ **Do Not** run a Dry Cycle when cleaning. Running a Dry Cycle will bake on the cleaning agent resulting in an odor [see sec. 6.7].
- ◆ **Do Not** spread the cleaning agent onto a hot Chamber. Doing so will cause the cleaning agent to burn and give off an odor [see sec. 6.7].

## **7.14 Door Problem**

### **7.14.1 Door is leaking Steam from the Door Gasket**

- ◆ The Door should be tightened until the Closing Device feels very snug, regardless of when the Door Light comes on.
- ◆ If the Door Gasket is cracked or worn, replace it [see sec. 6.2].
- ◆ Do not overtighten the door. Overtightening will deform the Door Gasket, which can lead to leaking and premature wear of the Door Gasket.

### **7.14.2 Door is leaking Steam near the Closing Device**

- ◆ Steam can be seen wisping out by the Closing Device; replace the Door Bellows [see sec. 10.11].
- ◆ Steam can be heard whistling out by the Closing Device; replace the Door Bellows [see sec. 10.11].
- ◆ Water is dripping and puddling on the counter right under the Closing Device; replace the Door Bellows [see sec. 10.11].

### **7.14.3 Door does not close properly**

- ◆ If the Door movement is stiff, lubricate the Door Hinge Pin.
- ◆ If lubrication does not help, repair the hinge assembly [see sec. 7.14.4].
- ◆ If the Closing Device is stiff and does not run in and out smoothly, lubricate the threaded shaft.
- ◆ If lubrication does not help, replace the Closing Device.
- ◆ If the Closing Device is screwed all the way down and the Door Gasket is not sealing the Chamber, check for:
  - A worn or damaged Door Gasket.
  - Damaged threads on the Closing Device.
  - Damaged bearing at the end of the threaded shaft on the Closing Device.
  - A loose Door Hinge.
- ◆ If the Door Hinge is loose, allowing the Door to hang down, this is most often more an inconvenience than a problem. As long as the hinge pin is not in danger of falling out and the Chamber is being sealed, no action need be taken. To repair this, see sec. 7.14.4.
- ◆ If the Plastic Door Cover is rubbing on the Cabinet when the Door is opened or closed, first determine which of the four mounting screws is closest to the problem. Take one or two flat washers and insert them between the tab of the metal Door and the mounting hole of the Plastic Door Cover. Inserting the washers will push the cover out and relieve the problem. If the problem is in the middle of two screws, both screws will need washers [see also sec. 7.14.5].

#### 7.14.4 Door hangs down

(See the drawings following this paragraph describing the different pin styles.)

##### **For Door assemblies without a brass bushing.**

Models **1730**, **2340** and **2540** that do not have a brass bushing in the door will have a hinge pin with two C-clips, one on top of the pin and one on the bottom (Style A1).

- ◆ If the hinge pin is the type with C-clips on top and bottom, remove the pin and examine it for straightness by rolling it along a flat surface.
- ◆ If the pin does not roll smoothly, replace it.
- ◆ If the pin is okay, insert it into the part of the hinge attached to the machine. The pin should move up and down smoothly. It should not be able to rock back and forth or side-to-side. Now check for the same movement in the Door part of the hinge.
  - If the pin is able to rock back and forth, rotate the pin  $\frac{1}{4}$  of a turn and recheck it.
  - If the looseness disappears, replace the pin.
  - If the looseness remains, replace that part of the hinge assembly.

When reassembling the hinge and pin, be sure to reinstall the C-clips in the grooves on the top and bottom of the pin.

#### **Caution \*\*\***

**Failure to install both top and bottom C-clips can result in the malfunction of the hinge assembly. This can result in the inability of the Door to keep the Chamber sealed while under pressure.**

**At this time, the only replacement hinge pin Tuttnauer will supply is a pin with a cap on top and a cotter pin in the bottom, Part # LOK240-0035 (Style A2).**

- ◆ If the Door hanging is due to a spread that has developed between the stops on the hinge, one or two nylon or brass flat washers can be inserted between the bottom stop and the Door to lift it up. Also, the hinge itself can be replaced.

Models **3850** and **3870** have two hinges supporting the door and do not normally develop the problem of hanging down.

These models do not come with a brass bushing in the door and will have one of the following styles of hinge pin.

1. It may be a pin with C-clips (top and bottom) (Style B1).
2. It may have a C-clip on top and a retaining ring on the bottom (Style B3).
3. It may have a pin with a cap on top and a cotter pin in the bottom (Style B2).

All three styles of hinge pin are interchangeable; however, **the only replacement part Tuttnauer will supply is a pin with a cap on top and a cotter pin in the bottom, Part # LOK240-0035.**

#### **For Door assemblies with a brass bushing**

This assembly will be found on models **1730**, **2340** and **2540** and the hinge pin will come in one of three styles

1. It may be a plain pin without C-clips (Style A3).
2. It may have a C-clip on top and a retaining ring on the bottom (Style A4).
3. It may have a pin with a cap on top and a cotter pin in the bottom (Style A2).

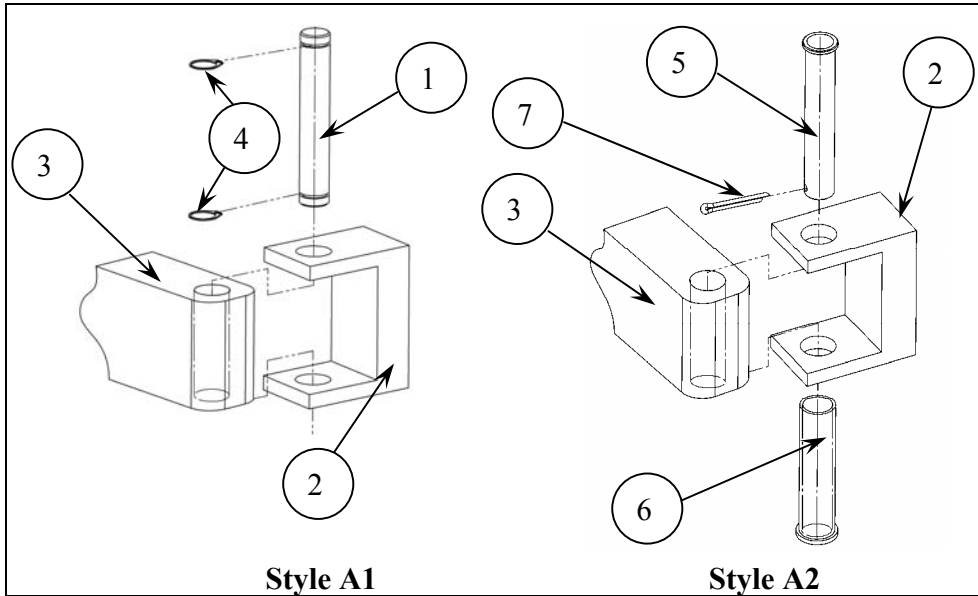
All these styles use a brass bushing in the door part of the assembly and a pressed pin to hold the assembly together. The bushing is designed to wear out before the pin or hinge itself. As a result, the brass bushing will need to be replaced from time to time.

Due to ASME (American Society of Mechanical Engineers) regulations and to insure the integrity of the Door assembly, the brass bushing can only be repaired at the **Tuttnauer Factory Repair Center**.

All three styles of hinge pin are interchangeable; however, **the only replacement part Tuttnauer will supply is a pin with a cap on top and a cotter pin in the bottom, Part # LOK240-0035.**

# RIGHT HINGE COMPONENTS

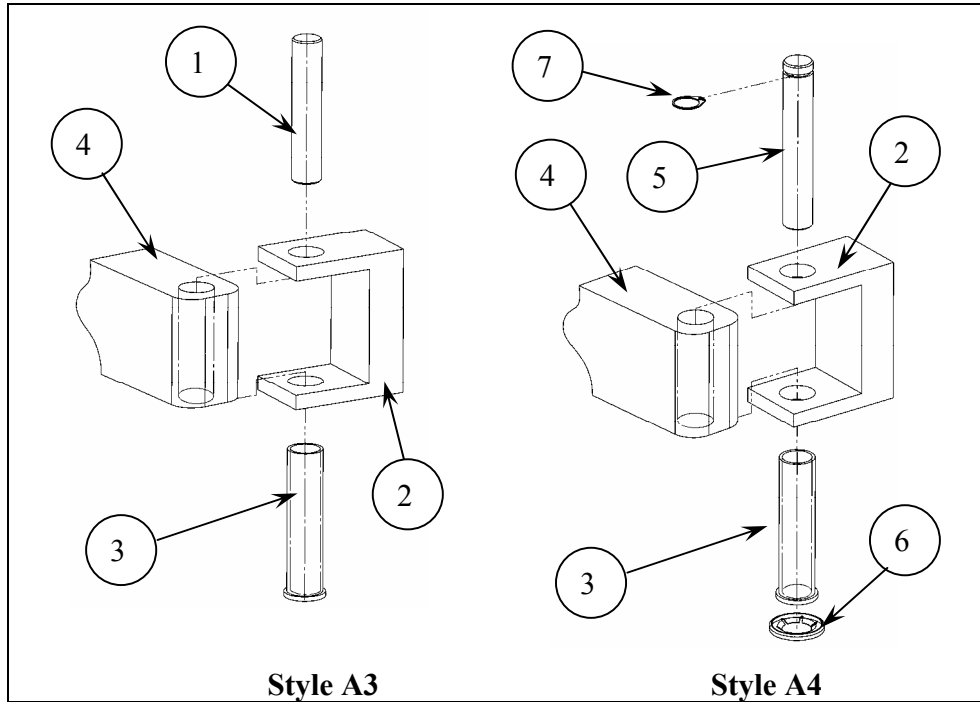
MODELS 1730, 2340, 2540



ITEM	PART NO.	DESCRIPTION
1	LOK240-0016	HINGE PIN 10mm (cylindrical pin with two C-Clips)
2	CT232010	RIGHT HINGE
3	CU240010 CT240010 CV240010	DOOR WITH BUSHING (PART NO. DEPENDS ON MODEL)
4	NUT193-0339	C-CLIP
5	LOK240-0035	HINGE PIN 10mm (with shoulder and hole)
6	CT211050	BRASS DOOR BUSHING 10mm
7	LOK692-0039	COTTER PIN

# RIGHT HINGE COMPONENTS

Models 1730, 2340, 2540

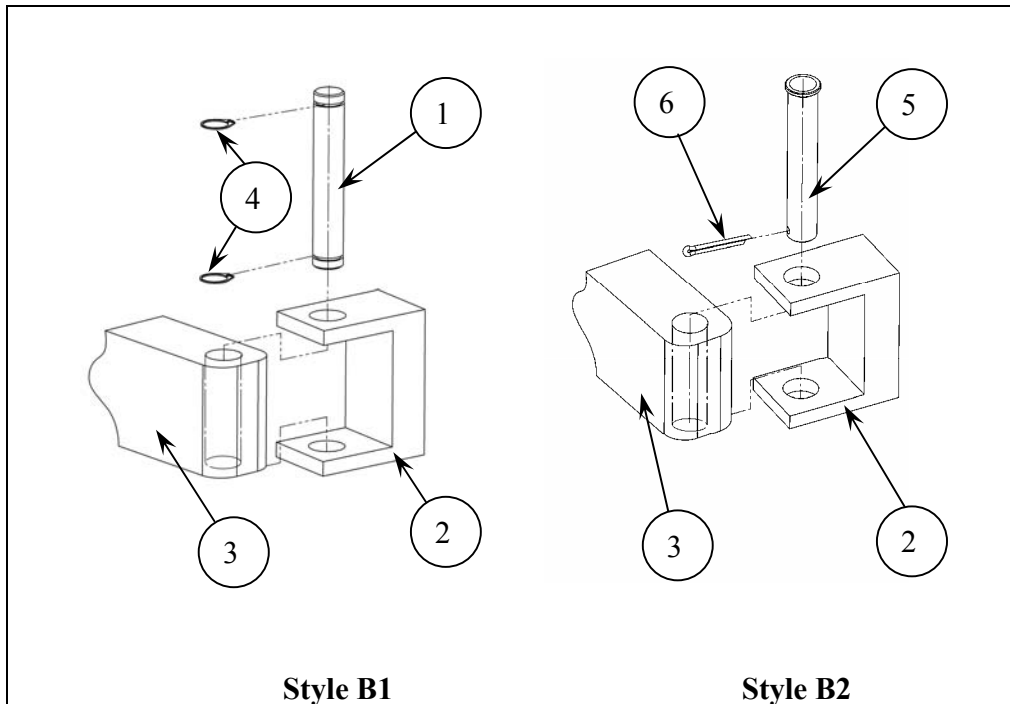


ITEM	PART NO.	DESCRIPTION
1	CT224030 (Ver 01)	HINGE PIN 10mm (plane cylindrical)
2	CT232010	RIGHT HINGE
3	CT211050	BRASS DOOR BUSHING 10mm
4	CU240010 CT240010 CV240010	DOOR WITH BUSHING (PART NO. DEPENDS ON MODEL)
5	CT224030 (Ver 02)	HINGE PIN 10mm (plane cylindrical)
6	NUT193-0346	STARLOCK WASHER
7	NUT193-0339	C-CLIP



# RIGHT HINGE COMPONENTS

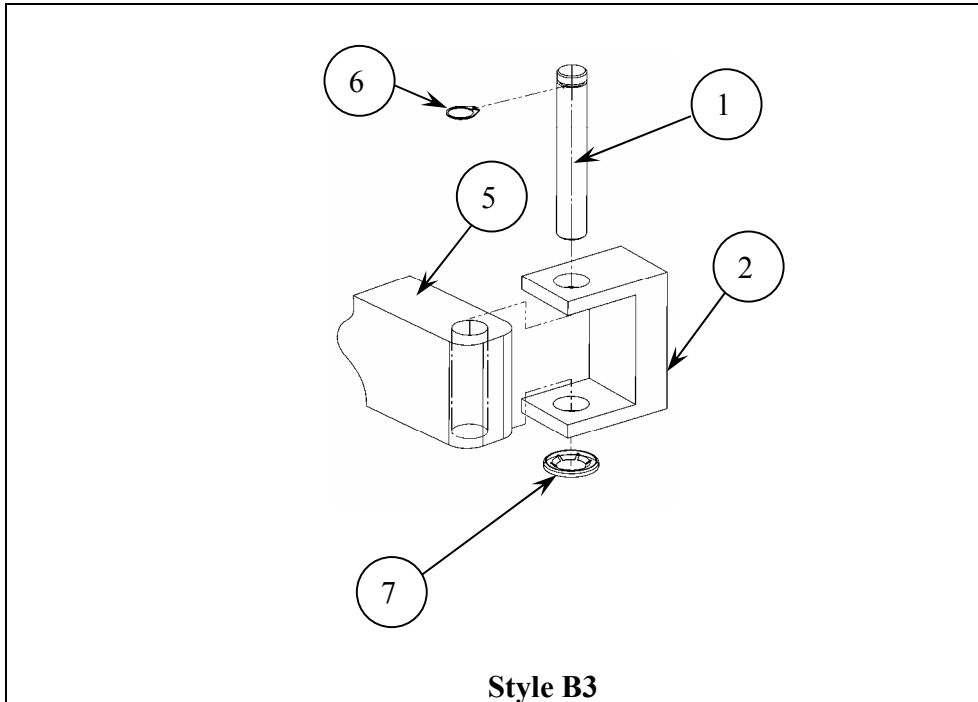
Models 3140, 3850, 3870



ITEM	PART NO.	DESCRIPTION
1	LOK240-0016	HINGE PIN 10mm (cylindrical pin with two C-Clips)
2	CT232010	RIGHT HINGE
3	CU211012	DOOR W/O BUSHING (PART NO. DEPENDS ON MODEL)
	CT211013	
	CV211014	
4	NUT193-0339	C-CLIP
5	LOK240-0035	HINGE PIN 10mm (with shoulder and hole)
6	LOK692-0039	COTTER PIN

# RIGHT HINGE COMPONENTS

Models 3140, 3850, 3870



ITEM	PART NO.	DESCRIPTION
1	CT 224030	HINGE PIN 10mm (plain cylindrical)
2	CT232010	RIGHT HINGE
3	CT211050	BRASS DOOR BUSHING 10mm
4	CU240010 CT240010 CV240010	DOOR WITH BUSHING (PART NO. DEPENDS ON MODEL)
5	CU211012 CT211013 CV211014	DOOR W/O BUSHING (PART NO. DEPENDS ON MODEL)
6	NUT193-0339	C-CLIP
7	NUT193-0346	STARLOCK WASHER

#### **7.14.5 Door Cover Rubbing**

- ◆ Determine the point at which the cover is rubbing or binding.
- ◆ Determine which of the four mounting points is closest to the problem.
- ◆ Once a mounting point has been isolated, remove the screw from that point and insert from one to three flat washers between the metal tab of the door and the plastic mount of the door cover. Reinstall the screw. This procedure should push the cover out and eliminate the rubbing.
- ◆ If the problem is located an equal distance between two mounting points, both screws should be removed and washers inserted under both tabs.

## 7.15 Water Fill Problem

### 7.15.1 Autoclave does not fill automatically

- ◆ Is the Reservoir filled with **Distilled Water** to just below the Pressure Relief Valve?
- ◆ Is there anything blocking the pickup tube at the bottom of the Reservoir?
- ◆ Is the Water Sensor, in the Chamber, clean? [see sec. 6.6]
- ◆ Is there **anything** touching or shorting out the Water Sensor?
- ◆ Check how much water the machine is filling itself with. [see sec. 2.4]
  - Leaving the door open, select a sterilization cycle; press and hold the Door Switch Button and press the Start Button.
  - Do you hear the Fill Solenoid click when the Start Button is pressed?
  - If a click is heard, is water flowing into the Chamber?
  - For units with Microprocessors dated T97DN7WP or later, in addition to hearing the click of the solenoid, do you hear the Water Pump?
- ◆ **If no water is flowing, the problem could be:**
  - **A clogged Filter Screen:** On machines manufactured before 9/96, at the back of the machine, remove the three screws on the round brass plate, remove the plate, take out and clean the screen. Machines manufactured between 9/96 and 2/2000 will have a screen located inside the Chamber in the fill hole at the back, clean or replace this screen. Units manufactured or repaired at Tuttnauer after 2/2000 will have a Chamber Strainer located at the left rear corner of the autoclave, either inside or outside the unit. Units with an external strainer will have a chrome cap on the back of the autoclave. **Caution! This cap can be hot.** Remove the cap to clean the strainer. Units with internal strainers will need to have the Outer Cabinet removed to access the strainer. Once the Outer Cabinet is removed, open and clean the strainer.
  - **A clogged Pump Strainer:** On units with Microprocessors dated T97DN7WP or later. Disassemble the Pump Strainer and clean the two wire mesh screens. If the white fiber filter screen is present it should be removed and discarded. [see sec. 6.11].
  - **A Malfunctioning Water Pump:** On units with Microprocessors dated T97DN7WP or later. Check the functioning of the Water Pump [see sec. 7.27].
  - **A clogged Water Filter:** In the bottom of the reservoir, on some models, there is a bronze filter. Clean or replace this filter if present.

- **A clog at the Water Fill Valve:** Remove the cover of the autoclave, open the valve and clean out the brass base assembly [see sec. 6.4].
- **A deformed seat on the Water Fill Valve Plunger:** Remove the cover of the autoclave, open the valve and replace the plunger [see sec. 10.7].
- **A clog in the Water Fill Line:** Remove the cover of the autoclave, open the waterline and clear the clog or replace that length of tubing.
- ◆ If no click is heard, release the Door Switch Button and press the button located on the keypad that is marked with the two arrows, this is the Manual Water Fill Button:
  - Do you hear the solenoid click when the button is pressed?
- ◆ If a click is heard when pressing the Manual Water Fill Button, but not heard when the Start Button was pressed, this would indicate a control problem [see sec. 7.20].
- ◆ If no click is heard when pressing the Manual Water Fill Button:
  - Check TP10 to TP1 on the Ajunc board for a 0 to 1 volt DC signal when the button is pushed and a 10 to 12 volt DC signal when the button is released.
  - If the correct voltages are not seen this would indicate a control problem [see sec. 7.20].
  - If the correct voltages are observed on the test points, check at the solenoid itself for the proper voltages [see sec. 8.3].
- ◆ If the solenoid is not receiving the correct voltages, check the wiring for a bad connection between the connection box on the solenoid and the back of the Ajunc board.
  - Repair the connection.
  - If the previous connection is good, replace the Ajunc board.
- ◆ If the correct voltages are observed, either the Solenoid is defective or the Plunger is stuck.
- ◆ Remove the Solenoid Coil and check it [see sec. 8.3].
- ◆ Remove the Plunger assembly and check for debris that may be stopping the Plunger from moving [see sec. 6.4].
- ◆ If a click is heard when pressing the Manual Water Fill Button, you should see water flowing into the chamber on units manufactured up to 2/2000.
 

If the unit was manufactured after 2/2000 and has a Microprocessor dated T97DN7WP or later, a Water Pump is installed and must also be running in order for water to flow.

If the pump is not running see sec. 7.27.
- ◆ If the solenoid is activating and the pump is running and water is still not flowing, see the section beginning with **“If no water is flowing, the problem could be”**.

### 7.15.2 Chamber does not fill manually

- ◆ Is the Reservoir filled with **Distilled Water** to just below the Pressure Relief Valve?
- ◆ Is there anything blocking the pickup tube at the bottom of the Reservoir?
- ◆ Press the button located on the keypad that is marked with the two arrows, this is the Manual Water Fill Button.
- ◆ Do you hear the solenoid click when the button is pressed?
- ◆ If no click is heard when pressing the Manual Water Fill Button:
  - Check TP10 to TP1 on the Ajunc board for a 0 to 1 volt DC signal when the button is pushed and a 10 to 12 volt DC signal when the button is released.
  - If the correct voltages were not seen, this would indicate a control problem [see sec. 7.20].
  - If the correct voltages are observed on the test points, check at the solenoid itself for the proper voltages [see sec. 8.3].
- ◆ If the solenoid is not receiving the correct voltages, check the wiring for a bad connection between the connection box on the solenoid and the back of the Ajunc board.
  - Repair the connection.
  - If the previous connection is good, replace the Ajunc board.
- ◆ If the correct voltages **are** observed, either the Solenoid is defective or the Plunger is stuck.
- ◆ Remove the Solenoid Coil and check it [see sec. 8.3].
- ◆ Remove the Plunger assembly and check for debris that may be stopping the Plunger from moving [see sec. 6.4].
- ◆ If a click is heard when pressing the Manual Water Fill Button, you should see water flowing into the chamber on units manufactured up to 2/2000.

If the unit was manufactured after 2/2000 and has a Microprocessor dated T97DN7WP or later, a Water Pump is installed and must also be running in order for water to flow. If the pump is not running see sec. 7.27.
- ◆ If the solenoid is activating and the pump is running and water is still not flowing, check for:
  - **A clogged Filter Screen:** on machines manufactured before 9/96, at the back of the machine, remove the three screws on the round brass plate, remove the plate, take out and clean the screen. Machines manufactured between 9/96 and 2/2000 will have a screen located inside the Chamber in the fill hole at the back, clean or replace this screen. Units manufactured or repaired at Tuttnauer after 2/2000 will have a Chamber Strainer located at the left rear corner of the autoclave, either inside or outside the unit. Units with an external strainer will have a chrome cap on the back of the autoclave. **Caution! This cap can be hot.** Remove the cap

to clean the strainer. Units with internal strainers will need to have the Outer Cabinet removed to access the strainer. Once the Outer Cabinet is removed, open and clean the strainer.

- **A clogged Pump Strainer:** on units with Microprocessors dated T97DN7WP or later. Disassemble the Pump Strainer and clean the two wire mesh screens. If the white fiber filter screen is present it should be removed and discarded. [see sec. 6.11].
- **A Malfunctioning Water Pump:** on units with Microprocessors dated T97DN7WP or later. Check the functioning of the Water Pump [see sec. 7.27].
- **A clogged Water Filter:** In the bottom of the reservoir, on some models there is a bronze filter. Clean or replace this filter if present.
- **A clog at the Water Fill Valve:** Remove the cover of the autoclave, open the valve and clean out the brass base assembly [see sec. 6.4].
- **A deformed seat on the Water Fill Valve Plunger:** Remove the cover of the autoclave, open the valve, and replace the plunger [see sec. 10.7].
- **A clog in the Water Fill Line:** Remove the cover of the autoclave, open the waterline and clear the clog or replace that length of tubing.

### 7.15.3 Chamber fills automatically, but not enough

- ◆ Is the Reservoir filled with **Distilled Water** to just below the Pressure Relief Valve?
- ◆ Is there anything blocking the pickup tube at the bottom of the Reservoir?
- ◆ Is the Water Sensor, in the Chamber, clean? [see sec. 6.6]
- ◆ Is there **anything** touching or shorting out the Water Sensor?
- ◆ Press the button located on the keypad that is marked with the two arrows, this is the Manual Water Fill Button:
  - By holding the Manual Water Fill Button, can the Chamber be filled in approximately 60 sec. (90 sec. for the 3870 model)?
- ◆ If it can manually fill in the right amount of time and the unit has a Microprocessor dated T97DN7WP or later, reset the automatic fill [see sec. 8.6].
- ◆ If the unit was manufactured before 2/2000, there may be a short in the Water Sensor. To check this, do the following:
  - Empty the Chamber of any water.
  - While filling the Chamber, using the Manual Water Fill Button, use a DVM to check between TP6 and TP1.
  - The correct reading should be between 0 and 1 volt DC until water touches the tip of the sensor. The voltage will then read between 3.5 and 5 volts.

- ◆ If the voltage changes, before the water has reached the top of the sensor, the sensor may be dirty and will need to be cleaned or it may have a short and should be replaced [see sec. 10.10].
- ◆ If the Water Sensor checks out okay reset the automatic fill, following the procedure outlined in sec. 8.6.
- ◆ If it cannot fill in the right amount of time, there is probably an obstruction in the line, check for:
  - **A Clogged Filter Screen:** on machines manufactured before 9/96, at the back of the machine, remove the three screws on the round brass plate, remove the plate, take out and clean the screen. Machines manufactured between 9/96 and 2/2000 will have a screen located inside the Chamber in the fill hole at the back, clean or replace this screen. Units manufactured or repaired at Tuttnauer after 2/2000 will have a Chamber Strainer located at the left rear corner of the autoclave, either inside or outside the unit. Units with an external strainer will have a chrome cap on the back of the autoclave. **Caution! This cap can be hot.** Remove the cap to clean the strainer. Units with internal strainers will need to have the Outer Cabinet removed to access the strainer. Once the Outer Cabinet is removed, open and clean the strainer.
  - **A Clogged Pump Strainer:** on units with Microprocessors dated T97DN7WP or later. Disassemble the Pump Strainer and clean the two wire mesh screens. If the white fiber filter screen is present it should be removed and discarded. [see sec. 6.11].
  - **A Malfunctioning Water Pump:** on units with Microprocessors dated T97DN7WP or later. Check the functioning of the Water Pump [see sec. 7.27].
  - **A Clogged Water Filter:** in the bottom of the reservoir, on some models, there is a bronze filter. Clean or replace this filter if present.
  - **A Clog at the Water Fill Valve:** remove the cover of the autoclave, open the valve and clean out the brass base assembly [see sec. 6.4].
  - **A Deformed seat on the Water Fill Valve Plunger:** remove the cover of the autoclave, open the valve and replace the plunger [see sec. 10.7].
  - **A Clog in the Water Fill Line:** remove the cover of the autoclave, open the waterline, and clear the clog or replace that length of tubing.



#### 7.15.4 Water flow does not stop

- ◆ Press the **Stop** button on the Keypad to abort any previous cycle.
- ◆ If the water stops flowing, check the Water Sensor [see sec. 8.7].
- ◆ If the water does not stop flowing, turn off the power to the machine.
- ◆ If water continues to flow and the unit was manufactured before 2/2000, the problem is in the Fill Valve. There is debris either on the seat or in the valve, stopping it from closing [see sec. 6.4].
- ◆ If the flow of water stops, turn the unit back on and check the Fill Valve control between TP10 and TP1 for the correct DC volt reading. 0 – 1 volt is open and 10 – 12 volts is closed.
- ◆ If the unit has a Microprocessor dated T97DN7WP or later, check the Water Pump control between TP13 and TP1 for the correct DC volt reading. 0-1 volt the pump is on and 10 – 12 volts the pump is off.
- ◆ If the correct voltages were not seen, this would indicate a control problem [see sec. 7.20].
- ◆ If the correct voltages are observed on the test points, check at the solenoid itself for the proper voltages [see sec. 8.3], also at the Water Pump SSR [see sec. 8.1].
- ◆ If the Fill Solenoid or the Water Pump SSR are not receiving the correct control voltages, check the wiring between the connection box or SSR and the back of the Ajunc board for a bad connection.
  - Repair the connection.
  - If the previous connection is good, replace the Ajunc board.

#### 7.15.5 Water fill takes longer the usual

- ◆ Check that the Air Outlet Valve is open. This valve should be open at the beginning of the fill cycle and will remain open until the unit reaches 195°F [see sec. 8.3].
- ◆ Check also for a clog in the fill line.

## 7.16 Leaking Water or Steam

### 7.16.1 Water leaking from under the autoclave

- ◆ Remove the Outer Cabinet and inspect all fittings for leaks. Tighten loose fittings and replace broken ones.
- ◆ Inspect the Water Reservoir for cracks or holes.
- ◆ Inspect the Heating Elements for signs of rust that would indicate a leak in the Chamber.
- ◆ Check if the Cooling Coil exit spout is pointed in a direction that would allow water to come out of the Reservoir. Reposition the Cooling Coil as necessary.
- ◆ Check if the Reservoir Gasket is in place and not damaged.
- ◆ Check that the Reservoir is not being overfilled. The Reservoir should never be filled while the unit is sterilizing. It should only be filled as high as the bottom of the Safety Valve Holder.
- ◆ Check if while cleaning the autoclave, rinse water hasn't spilled out of the Chamber and run underneath the Chamber into the autoclave.

### 7.16.2 Water leaking from the Drain Valve

- ◆ Unscrew the Drain Valve until it comes out of the autoclave. It may feel tight but continue to unscrew, it will come out.
- ◆ Clean any debris from the inside end of the valve that may be stopping the Drain Valve from completely closing.
- ◆ Flush the Drain Tube by running water through the Reservoir. It may be necessary to blow compressed air through the Drain Tube to completely clear it. Be sure to cover the Reservoir opening.
- ◆ Replace the Inner and Outer O-Rings.
- ◆ Reinstall the Drain Valve. Once the valve is screwed in halfway, use a small screwdriver to press the Outer O-Ring back into the groove in the Drain Valve Base, continue screwing in the valve.

### 7.16.3 Water leaking back into the Chamber

- ◆ The Reservoir may be overfilled.
- ◆ For **E** and **EK** machines, check that the exit end of the Cooling Coil is not below the water line. This can cause water to be sucked back into the Chamber during the Dry Cycle, or if no Dry Cycle is programmed, during the normal cool down of the machine.
- ◆ For **E** and **EK** machines, check if there is any kind of perforation in the Cooling Coil below the water line. This too can result in water being drawn back into the Chamber during Drying or cool down.

- ◆ For some **EA, EKA, EZ** and **EZ10k** machines, it is normal for the exit end of The Cooling Coil to be below the water line. These machines have a Check Valve to prevent back flow. If suck back is occurring during the Dry Cycle or normal cool down, replace the Check Valve.
- ◆ Check if the Fill Valve is leaking. Using a metal object, like a screwdriver, check if the Fill Solenoid is magnetized. When the valve is closed it should not be magnetic. If it is magnetic, check between TP10 and TP1 to tell if the Fill Valve is being told to open or close. A reading of 0 to 1 volt DC means the valve should be open and 10 to 12 volts closed.
  - If there is a reading of 10 to 12 volts DC and the coil is magnetic, this would indicate a short. Check the **Black** wire going to the coil for a short to ground. Also, check the coil itself for a short [see sec. 8.3].
  - If no shorts are detected and TP10 is showing a low reading and the coil is magnetized, this would indicate a control problem [see sec. 7.20].
- ◆ Open the Fill Solenoid Valve and check for any debris that might be stopping the valve from closing properly. Debris can be either on the Plunger Seat or in the Plunger assembly, restricting movement of the Plunger. Any debris interfering with the valve will allow water to run from the Reservoir into the Chamber.
  - Disassemble the valve and blow out the lines leading in and out of the valve base. This will remove any debris that may be floating in the line and intermittently obstructing the valve.
  - Also, check the seat of the Plunger for any debris or deformities. If the seat is swelled or otherwise deformed, replace the Plunger [see sec. 10.7].

#### 7.16.4 Steam leaking from the Chamber

- ◆ Check the Door Gasket for cracks or other signs of wear.
- ◆ Check the Door Bellows for leaking, such as a puddling of water on the counter below the Closing Device or a wisping of steam by the Closing Device or a whistling, all while the autoclave is running a cycle.
- ◆ Check that the Door is closing properly and sealing the Chamber [see sec. 7.14].
- ◆ Check the fittings on any plumbing directly connected to the Chamber.
- ◆ Inspect the Heating Elements for signs of rust that would indicate a leak in the Chamber.
- ◆ Open all the Solenoid Valves and inspect for any debris that may be causing the Plunger to stick. Also, check for any deformities of the Plunger seat [see sec. 6.4].

## 7.17 Air Outlet Valve Problem

### 7.17.1 Air Outlet blows off during sterile cycle

**The Air Outlet will blow off during the sterile cycle if the pressure rises above 34 psi**

- ◆ Check that the temperature setting is not set any higher than 273°F (134°C) [see sec. 5.3].
- ◆ Check that the Heating Elements are turning on and off properly [see sec. 8.2].
- ◆ Check that the Heating Elements are installed properly [see sec. 10.1].
- ◆ Recalibrate the pressure sensor [see sec. 8.5].
- ◆ Recalibrate the temperature sensor [see sec. 8.4].

### 7.17.2 Air Outlet stays open all the time

- ◆ Check between TP14 and TP1; the reading should be between 3.5 and 5 volts DC when the valve is off and 0 to 1 volt when the valve is on.
- ◆ If TP14 is showing 0 to 1 volt constantly, this indicates a control problem [see sec. 7.20].
- ◆ If TP14 is between 3.5 and 5 volts and the valve is open, check for a ground short in the black wire going from the solenoid to the Electronic Box.
- ◆ Remove the Solenoid Coil and check across the terminals for a short [see sec. 8.3].
- ◆ Take apart the Plunger Assembly and clean any debris that may be stopping the Plunger from sliding back and forth [see sec. 6.4].
- ◆ Check the housing of the Plunger for any nicks or distortions that can cause the Plunger to become stuck [see sec. 10.7].

### 7.17.3 Air Outlet stays closed all the time

- ◆ Check between TP14 and TP1 for a 0 to 1 volt DC reading. If TP14 never shows between 0 and 1 volt this would indicate a control problem [see sec. 7.20].
- ◆ Check for a broken orange or black wire going to the Solenoid Coil.
- ◆ Remove the Solenoid Coil and check for a short in the Solenoid Coil [see sec. 8.3].
- ◆ Remove the connection box from the Solenoid Coil and check that the connectors are in place and making good contact with the terminals on the Solenoid Coil [see sec. 8.3].
- ◆ Check that the Plunger Assembly is clean and not sticking [see sec. 6.4].
- ◆ Check that the Plunger Housing is not deformed and causing the plunger to stick [see sec. 10.7].

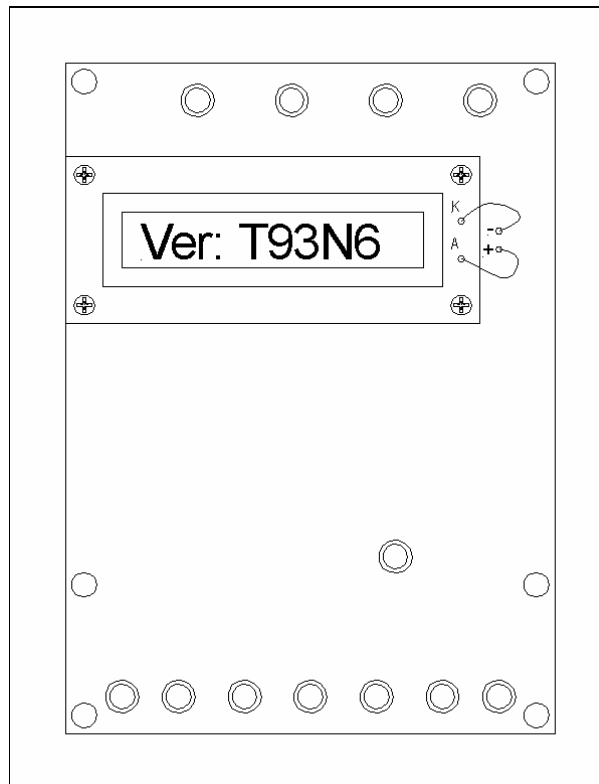
#### **7.17.4 Air Outlet opens at the wrong time**

- ◆ If the unit has a defective LM34 temperature sensor (not a PT100 or LM34 replacement kit) this can cause the Air Outlet Valve to open at the wrong time. A good indication of a bad temperature sensor is if the display changes abruptly either by itself or when the wire is touched.
- ◆ Check between TP14 and TP1 for the correct signal voltage, either a 0 to 1 volt DC reading if the valve is supposed to be open or 3.5 to 5 volts if the valve should be closed. If TP14 shows an incorrect signal, this would indicate a control problem [see sec. 7.20].
- ◆ Check for a shorted black wire going to the Solenoid Coil.
- ◆ Remove the Solenoid Coil and check for a short in the Solenoid Coil [see sec. 8.3].
- ◆ Remove the connection box from the Solenoid Coil and check that the connectors are in place and making good contact with the terminals on the Solenoid Coil [see sec. 8.3].

## 7.18 Display Problem

### 7.18.1 Display back light is very faint

- ◆ Check between TP17 and TP1 for +5 volts DC. If the voltage is not correct see sec. 7.19.
- ◆ If the other LEDs are functioning, the display is most likely damaged. Replace the LCD Display or replace the Digital Predg board.
- ◆ When replacing the LCD Display, it will be necessary to solder two wires. Make sure that “K” on the LCD is connected to “minus” on the Digital Predg Board and “A” is connected to “plus”.



### 7.18.2 The display is on but no characters are visible

- ◆ Check between TP17 and TP1 for +5 volts DC. If the voltage is not correct see sec. 7.19.
- ◆ Adjust P1 on the Digital Predg board [see sec. 9.2].
- ◆ Replace the Microprocessor.
- ◆ If the other LEDs are functioning, the display is most likely damaged. Replace the Digital Predg board.

### **7.18.3 Display shows wrong characters**

- ◆ Check between TP17 and TP1 for +5 volts DC. If the voltage is not correct see sec. 7.19.
- ◆ Replace the Back Up Battery / Real Time Clock.
- ◆ Replace the Microprocessor.
- ◆ Replace the Digital Predg board.

### **7.18.4 Display Flickers**

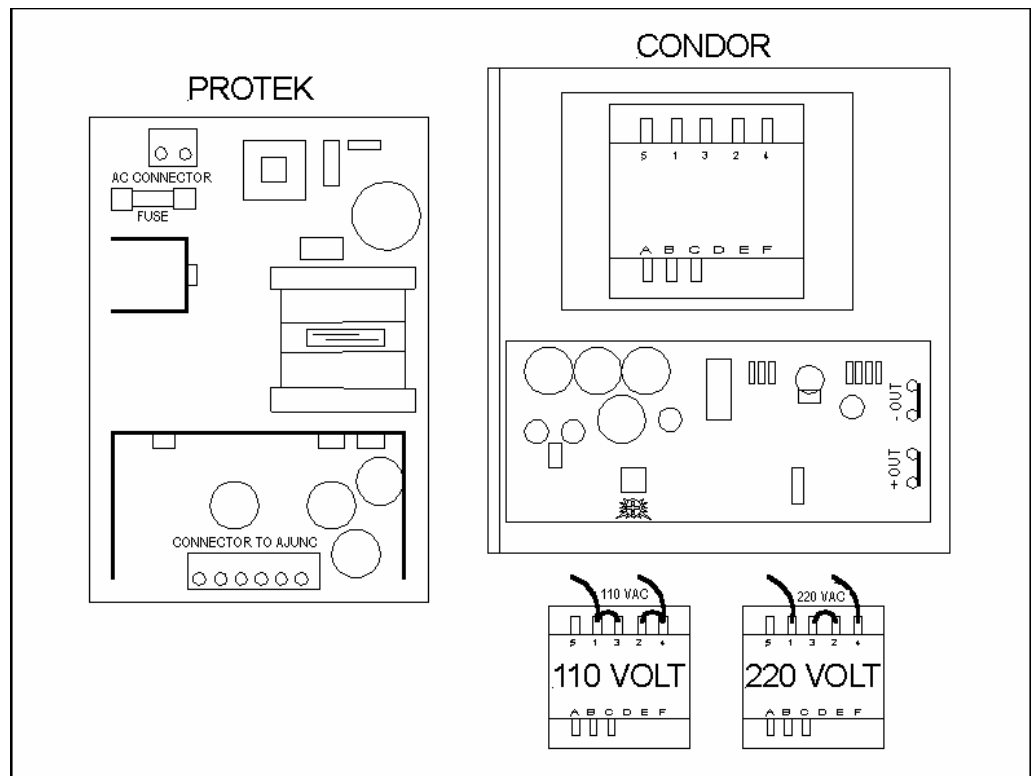
- ◆ Check between TP17 and TP1 for +5 volts DC. If the voltage is not correct see sec. 7.19.
- ◆ Adjust P1 on the Digital Predg board [see sec. 9.2].
- ◆ Replace the Back Up Battery / Real Time Clock.
- ◆ Replace the Microprocessor.
- ◆ Replace the Digital Predg board.

## 7.19 Power Supply Problem

### 7.19.1 Power supply has no power on the input side

**Be sure to turn the power off when connecting or disconnecting wires during troubleshooting of the power supply**

- ◆ Is the unit plugged in?
- ◆ Is the proper voltage coming out of the wall outlet?  
Whether this is a **Condor** or a **Protek** Power Supply, when set up for 110 volt operation, the Power Supply should have an input voltage between 110 and 125 volts AC.  
When set up for 220 volt operation, there should be an input voltage between 220 and 235 volts AC
- ◆ Is the power supply fuse blown?
  - On **Condor** Power Supplies the fuse is located at the back of the autoclave above the line cord. The replacement fuse is 1.2 amps.
  - On **Protek** Power Supplies the fuse is located on the power supply itself. The replacement fuse for this supply is 2.0 amps.



- ◆ Turn the power off and remove the Power Supply **OUTPUT** wires at the JP3 connector on the Ajunc Board, turn the power on and check the input side of the Power Supply for the correct input voltage. Do not disconnect the input wires yet.



- A 110 volt machine should have between 110 and 125 volts AC across the input wires.
- A 220 volt machine should have between 220 and 235 volts AC across the input wires.
- ◆ If no voltage is present:
  - Turn the power off and remove **INPUT** wires from the Power Supply.
  - Turn the power back on and check for the correct input voltage.
- ◆ If the line voltage is present on the input wires only when the wires are disconnected, replace the Power Supply.
- ◆ If the line voltage is not present on the input wires, when the wires are disconnected:
  - Check for loose or broken wires at the On/Off Switch.
  - Check for broken On/Off Switch.
  - Check for loose or disconnected Molex connector on the back of the Electronic Box.
  - Check for loose wires in the Molex connector on the back of the Electronic Box.
  - Remove both wires from the terminals of the Cut-Out Thermostat. Take an ohm reading across the two terminals to see if the device is closed. If not, reset the Cut-Out Thermostat and test again. If continuity cannot be seen, see the section on Temperature Safety Thermostat Problems [see sec. 7.7].
  - Check that the line voltage appears across the output side of the Circuit Breaker or Fuses. If it cannot be seen, check the section on Circuit Breaker and Fuse Problems [see sec. 7.8].
  - Check that the Line Cord is in good condition and conducting electricity.

### 7.19.2 Power supply has no power on the output side

#### **Be sure to turn the power off when connecting or disconnecting wires during troubleshooting of the power supply**

- ◆ Check the input side of the Power Supply.
- ◆ If there is no input power, see sec. 7.19.1.
- ◆ If there is input power:
  - Is the power supply fuse blown?
    - On **Condor** Power Supplies the fuse is located at the back of the autoclave above the line cord. The replacement fuse for this supply is 1.2 amps.
    - On **Protek** Power Supplies the fuse is located on the power supply itself. The replacement fuse for this supply is 2.0 amps.

- Disconnect the Power Supply output wires going to the Ajunc Board at the Ajunc Board JP3 connector and check the supply side of these wires for the proper voltage with respect to ground.
- If testing the **Condor** Power Supply, only check for +12 volts DC between the black and red wires, pins 1 and 3 on the JP3 connector.
- If testing the **Protek** Power Supply, check for +5 and +12 volts DC.
  - For +5 volts DC read between the black and orange wires pins 1 and 2.
  - For +12 volts DC read between the black and red wires pins 1 and 3.
- ◆ If the proper voltages are not present, change the Power Supply.
- ◆ If voltages are present:
  - Disconnect **ALL** other wires connected to the Ajunc Board including the Digital Predg board and Printer (if one is present).
  - Reconnect the Power Supply output wires to the JP3 connector.
  - If the output voltages disappear again, including the +5 volts on units with a **Condor** Power Supply, replace the Ajunc Board (for units with a **Condor** Power Supply, also replace the 5 volt Power Transistor mounted to the back of the Electronic Box).
- ◆ If the Power Supply output voltages are present while monitoring those output voltages, reconnect the wires one at a time making certain to turn off the power before connecting each wire. Whichever connection results in a lost output, the wiring should be checked for shorts. If no shorts are found, the device connected to those wires should be inspected and most probably replaced.

### 7.19.3 Power supply shuts off intermittently

**Be sure to turn the power off when connecting or disconnecting wires during troubleshooting of the power supply.**

- ◆ Make sure the boards in the Electronic Box are free of any dust buildup.
- ◆ Check for proper voltage on the input of the Power Supply. If voltages are too low or too high, even for short periods of time, this can create a problem for the power supply.

Whether this is a **Condor** or a **Protek** Power Supply:

- When set up for 110 volt operation the Power Supply should have an input voltage between 110 and 125 volts AC.
- When set up for 220 volt operation there should be an input voltage between 220 and 235 volts AC.
- ◆ Turn the autoclave off and back on to reset the Power Supply.
- ◆ Check for loose wire or cable connections throughout the autoclave.

- ◆ One at a time, disconnect each connector in or on the outside of the Electronic Box, inspect each connector for bent or broken pins. Reconnect each connector making sure a good solid connection is established.
- ◆ Check for any wires that may be pinched or where the insulation is worn away, causing that wire to ground out to some metal part of the autoclave.
- ◆ Remove each Solenoid Coil and check with an ohmmeter for any sign of shorting [see sec. 8.3].
- ◆ Replace the Power Supply.

## 7.20 Control Problem

If you have diagnosed the machine down to a Control Problem, you are essentially concerned with a problem on or between the printed circuit boards. By now you should have eliminated all other mechanical and operator type problems. You should have replaced any malfunctioning components other than the circuit boards and performed the appropriate calibrations.

- ◆ The first step when dealing with a Control Problem is to check the integrity of the cables connected to the circuit boards.
  - One at a time, disconnect every cable inside and outside the Electronic Box.
  - Inspect the pins on each connector, making sure none are bent or broken.
  - If any cable connector appears damaged, replace it.
  - Reconnect the cables, making sure there are good solid connections.
  - If there is a Printer installed, leave the Printer disconnected (since the printer is connected directly to the main Data Buss, a problem with the printer can cause problems elsewhere in the electronics).
- ◆ The next step is to determine which circuit board is causing the problem and should be replaced. We do not recommend changing components on the circuit boards.
- ◆ Where test points are noted, refer to sec. 9.5 and sec. 9.6 for specific voltage readings.
- ◆ Replace the Digital Predg board if there is a control problem with one of the following:
  - Temperature Sensor (if the unit has an Ajunc 2 board).
  - Temperature Sensor (if the unit has an Ajunc 3 board and the calibration procedure was successful).
  - Pressure Sensor (if the calibration procedure was successful).
  - Add Water Indicator and the reading at TP8 is **correct**.
  - Air Outlet Valve and the reading at TP14 are **incorrect**.
  - Dry Pump and the reading at TP20 for Ajunc 3 (TP18 for Ajunc 2) is **incorrect**.
  - Exhaust Valve.
  - Heat Control.
  - Fan Control on units manufactured before 2/2000.
  - Water Pump Control on units with Microprocessors dated T97DN7WP or later.
  - Water Fill on units manufactured before 2/2000.
  - Printer.
  - Keypad.
  - Float Switch.

- ◆ Replace the Ajunc board if the problem is with one of the following:
  - Fan Control on units with Microprocessors dated T97DN7WP or later.
  - Temperature Sensor cannot be calibrated.
  - Pressure Sensor cannot be calibrated.
  - Add Water Indicator and the reading at TP8 is **incorrect**.
  - Air Outlet Valve and the reading at TP14 is **correct**.
  - Dry Pump and the reading at TP20 for Ajunc 3 (TP18 for Ajunc 2) is **correct**.

## **7.21 Printer Problem**

### **7.21.1 Printer does not print**

- ◆ Make sure there is paper in the Printer.
- ◆ Make sure the paper is installed correctly [see sec. 10.13].
- ◆ Make sure the paper is thermal paper.
- ◆ Make sure there are no scraps of paper stuck in the printer head.
- ◆ Turn the unit off, unplug and replug in the Printer Cable.
- ◆ Make sure the # 8 dip switch (on the Digital Predg board) is in the up position. Cycle the machine off and on if you had to move the dip switch.
- ◆ Turn the power off, press and hold the FEED button on the Printer and turn the power back on. This should print a test pattern.
- ◆ If the Printer will not print a test pattern, replace the Printer.
- ◆ If the Printer does print a test pattern, but will not print data, replace the Printer Cable and/or the Digital Predg board [see sec. 10.13, sec. 10.19].

### **7.21.2 Printer prints upside down**

- ◆ Turn the unit off.
- ◆ Remove the front cover of the Printer.
- ◆ In the upper left hand corner of the Printer, on the bottom side of the circuit board, there is a small switch. This switch must be positioned to the left.
- ◆ Replace the Printer Cover.
- ◆ Turn the unit back on.

### **7.21.3 Printer characters are illegible**

- ◆ Make sure the paper is installed correctly [see sec. 10.13].
- ◆ Make sure the paper is thermal paper.
- ◆ Make sure there are no scraps of paper stuck in the printer head.
- ◆ Turn the unit off, unplug and replug the printer cable.
- ◆ Turn the power off, press and hold the FEED button on the printer and turn the power back on. This should print a test pattern.
- ◆ If the Printer will not print a test pattern, replace the Printer.
- ◆ If the Printer does print a test pattern, but will not print data correctly, replace the Printer Cable and/or the Digital Predg board [see sec. 10.13, sec. 10.19].

#### **7.21.4 Feed button does not advance the paper**

- ◆ Make sure the **Paper Out Light** on the Printer is not lit. This indicates that the paper is not up high enough for the Printer to see it.
- ◆ Push the paper up into the Printer.
- ◆ If the paper is up in the Printer but the **Paper Out Light** is still lit, replace the Printer.

#### **7.21.5 Printer Repair**

No parts are available for repairing the Printer.

## 7.22 Add Water Indicator Problem

### 7.22.1 Add Water Indicator is always on

- ◆ Check that the Float Switch is free to move up and down. If the switch sticks or is stuck, replace it.
- ◆ Check the connector at JP2 on the Ajunc board for a loose connection or a broken wire.
- ◆ Check between TP8 and TP1 for a DC voltage of 0 to 1 volt, if the water level in the reservoir is above the level of the Reservoir Float and 3.5 to 5 volts, if the level is below the level of the float.
  - If the readings are correct but the indicator light remains on all the time, the problem is with the Digital Predg board or the Flat Cable between the Predg and Ajunc boards.
  - Inspect the Flat Cable for loose connectors and bent or broken pins. Insure a good connection when reconnecting the Flat Cable.
  - If the problem is still not corrected, replace the Digital Predg board [see sec. 10.19].
  - If the readings are not correct, check continuity across the Float Switch. Cut the wires going to the Float Switch, if necessary, connect an ohmmeter and move the Float Switch up and down.
  - When in the up position the meter should show continuity.
  - When in the down position the meter should show an open circuit.
  - If the continuity check fails, replace the Float Switch [see sec. 10.16].
  - If the Float Switch checks out okay, there is a Control Problem [see sec. 7.20].

### 7.22.2 Add Water Indicator is always off

- ◆ Check that the Float Switch is free to move up and down. If the switch sticks or is stuck, replace it.
- ◆ Check the connector at JP2 on the Ajunc board for loose a connection or a broken wire.
- ◆ Check the wires going to the Float Switch for any shorts to the chassis.
- ◆ Check between TP8 and TP1 for a DC voltage of 0 to 1 volt, if the water level in the reservoir is above the level of the Reservoir Float and 3.5 to 5 volts, if the level is below the level of the float.
  - If the readings are correct but the indicator light remains off all the time, the problem is with the Digital Predg board or the Flat Cable between the Predg and Ajunc boards.
  - Inspect the Flat Cable for loose connectors and bent or broken pins. Insure a good connection when reconnecting the Flat Cable.



- If the problem is still not corrected, replace the Digital Predg board [see sec. 10.19].
- If the readings are not correct, check continuity across the Float Switch. Cut the wires going to the Float Switch, if necessary, connect an ohmmeter and move the Float Switch up and down.
- When in the up position, the meter should show continuity.
- When in the down position, the meter should show an open circuit.
- If the continuity check fails, replace the Float Switch [see sec. 10.16].
- If the Float Switch checks out okay, there is a Control Problem [see sec. 7.20].

### **7.22.3 Add Water Indicator operates in reverse**

- ◆ Check that the Float Switch is free to move up and down. If the switch sticks or is stuck, replace it.
- ◆ Check the connector at JP2 on the Ajunc board for a loose connection or a broken wire.
- ◆ Check between TP8 and TP1 for a DC voltage of 0 to 1 volt, if the water level in the reservoir is above the level of the Reservoir Float and 3.5 to 5 volts, if the level is below the level of the float.
  - If the readings are correct but the indicator light is still opposite of the Float Switch, the problem is with the Digital Predg board or the Flat Cable between the Predg and Ajunc boards.
  - Inspect the Flat Cable for loose connectors and bent or broken pins. Insure a good connection when reconnecting the Flat Cable.
  - If the problem is still not corrected, replace the Digital Predg board [see sec. 10.19].
  - If the readings are reversed, the Float Switch is upside down and needs to be turned around [see sec. 10.16].

## 7.23 Door Closed Indicator Problem

### 7.23.1 Door Closed Indicator is always on

- ◆ Check that the Door Switch is free to move in and out by pressing and releasing it. If the switch sticks or is stuck, replace it.
- ◆ Check the wire going to the Door Switch for any shorts to the chassis. Check between TP9 and TP1 with a DC voltmeter. Press the Door Switch in and release it. The meter should show 0 to 1 volt when pressed in and 3.5 to 5 volts when the Door Switch is released.
  - If the readings are correct and the indicator remains on, the problem is with the Digital Predg board or the Flat Cable between the Predg and Ajunc boards.
  - Inspect the Flat Cable for loose connectors and bent or broken pins. Insure a good connection when reconnecting the Flat Cable.
  - If the problem is still not corrected, replace the Digital Predg board [see sec. 10.19].
  - If the readings are not correct, remove the green wire attached to the Door Switch and check continuity across the normally open contact of the Door Switch with an ohmmeter.
  - When the Door Switch is pressed in, the meter should show continuity.
  - When the Door Switch is released, the meter should show an open circuit.
  - If the continuity check fails, replace the Door Switch.
  - If the Door Switch is okay, there is a Control Problem [see sec. 7.20].

### 7.23.2 Door Closed Indicator is always off

- ◆ Check that the Door Switch is free to move in and out by pressing and releasing it. If the switch sticks or is stuck replace it.
- ◆ If pressing the Door Switch in, with the power on, causes the indicator to come on the problem is either:
  - The Door Switch Activator is misadjusted or missing
  - The Door is not being closed tight enough [see sec. 5.4].
- ◆ Check that there is a good ground connection from the common side of the Door Switch to the chassis.
- ◆ Check the connector at JP2 on the Ajunc board for a loose connection or a broken wire.
- ◆ Check between TP9 and TP1 with a DC voltmeter. Press the Door Switch in and release it. The meter should show 0 to 1 volt when pressed in and 3.5 to 5 volts when the Door Switch is released.
  - If the readings are correct and the indicator remains off, the problem is with the Digital Predg board or the Flat Cable between the Predg and Ajunc boards.

- Inspect the Flat Cable for loose connectors and bent or broken pins. Insure a good connection when reconnecting the Flat Cable.
- If the problem is still not corrected, replace the Digital Predg board [see sec. 10.19].
- If the readings are not correct, remove the green wire attached to the Door Switch and check continuity across the normally open contact of the door switch with an ohmmeter.
- When the Door Switch is pressed in, the meter should show continuity.
- When the Door Switch is released, the meter should show an open circuit.
- If the continuity check fails, replace the Door Switch.
- If the Door Switch is okay, there is a Control Problem [see sec. 7.20].

### **7.23.3 Door Closed Indicator operates in reverse**

- ◆ Check that the Door Switch is free to move in and out by pressing and releasing it. If the switch sticks or is stuck, replace it.
- ◆ Check that the green wire is connected to the normally open contact of the Door Switch and that the ground wire is connected to the common.
- ◆ Check the connector at JP2 on the Ajunc board for loose connection or a broken wire.
- ◆ Check the wire going to the Door Switch for any shorts to the chassis.
- ◆ Check between TP9 and TP1 with a DC voltmeter. Press the Door Switch in and release it. The meter should show 0 to 1 volt when pressed in and 3.5 to 5 volts when the Door Switch is released.
  - If the readings are correct and the indicator still operates in reverse, the problem is with the Digital Predg board or the Flat Cable between the Predg and Ajunc boards.
  - Inspect the Flat Cable for loose connectors and bent or broken pins. Insure a good connection when reconnecting the Flat Cable.
  - If the problem is still not corrected, replace the Digital Predg board [see sec. 10.19].
  - If the readings are not correct, remove the green wire attached to the Door Switch and check continuity across the normally open contact of the Door Switch with an ohmmeter.
  - When the Door Switch is pressed in, the meter should show continuity.
  - When the Door Switch is released, the meter should show an open circuit.
  - If the continuity check fails, replace the Door Switch.
  - If the Door Switch is okay, there is a Control Problem [see sec. 7.20]

## 7.24 Memory Problem

### 7.24.1 User parameters are not saved

- ◆ The Backup Battery is weak.
- ◆ Replace the Backup Battery on the Digital Predg board at location U2 [see sec. 9.2].

### 7.24.2 Date and time are not saved

- ◆ The Backup Battery is weak.
- ◆ Replace the Backup Battery on the Digital Predg board at location U2 [see sec. 9.2].

### 7.24.3 Reset the unit to factory defaults

- ◆ Turn the power off.
- ◆ Press and hold the Stop button on the Keypad.
- ◆ Turn the power on.
- ◆ Wait for the normal display screen to come up.
  - All the parameters will now have been reset, including the **Automatic Water Fill**.
  - The **Automatic Water Fill** should be checked and may need to be calibrated [see sec. 8.6].

## 7.25 Exhaust Problem

### 7.25.1 Steam does not exhaust

In order to perform these electrical checks, do the following:

- ◆ For units with an Ajunc 2 board - Turn the unit on and start a Dry only cycle. During the Dry mode the Exhaust Valve should be open.

**\*\*\* Caution \*\*\***

**The Heating Elements will come on and the chamber will get hot.**

- ◆ For units with an Ajunc 3 board - Run the In/Out Test [see sec. 8.13] or run an unwrapped instrument cycle and wait for the Exhaust mode.
- ◆ Check between TP11 and TP1; a DC voltage of 0 to 1 volt indicates that the valve should be open and 10 to 12 volts indicates that it should be closed.
- ◆ If TP11 is between 0 to 1 volt and the valve is closed, check for a loose connector or broken orange or black wire going from the solenoid to the Electronic Box.
- ◆ Check if the Solenoid Coil has received the proper signal [see sec. 8.3].
- ◆ Remove the Solenoid Coil and check across the coil terminals for a short [see sec. 8.3].
- ◆ Remove the connection box from the Solenoid Coil and check that the connectors are in place and making good contact with the terminals on the Solenoid Coil [see sec. 8.3].

Before continuing, do the following:

- ◆ Relieve any pressure that may still be inside the Chamber by pulling on the ring of the Safety Relief Valve.

**\*\*\* Caution \*\*\***

**Be careful not to position your head over the valve. This can result in a severe burn.**

- ◆ Empty any water from inside the Chamber.
- ◆ Take apart the Plunger Assembly and clean any debris that may be stopping the Plunger from sliding back and forth [see sec. 6.4].
- ◆ Check the housing of the Plunger for any nicks or distortions that can cause the Plunger to become stuck [see sec. 10.7].
- ◆ Blow compressed air from the Valve Base through the tubes going to the Chamber and the Water Reservoir. This will clean out any clogs that may have developed. If the tubing remains clogged, remove it and clean it manually or replace it. On units manufactured after 2/2000, open the Chamber Strainer to check for clogs. When blowing compressed air, blow from the Exhaust Valve Base to the Chamber Strainer then from the Chamber Strainer to the Chamber [see sec. 6.11].

### **7.25.2 Exhaust Valve stays open all the time**

- ◆ Check between TP11 and TP1. The reading should be between 10 and 12 volts DC when the valve is off and 0 to 1 volt when the valve is on.
  - If TP11 is showing 0 to 1 volt constantly, this indicates a control problem [see sec. 7.20].
  - If TP11 is between 10 and 12 volts and the valve is open, check for a ground short in the black wire going from the solenoid to the Electronic Box.
  - Remove the Solenoid Coil and check across the terminals for a short [see sec. 8.3].
- ◆ Empty any water from inside the Chamber.
- ◆ Take apart the Plunger Assembly and clean any debris that may be stopping the Plunger from sliding back and forth [see sec. 6.4].
- ◆ Check the housing of the Plunger for any nicks or distortions that can cause the Plunger to become stuck [see sec. 10.7].

### **7.25.3 Exhaust Valve opens at the wrong time**

- ◆ Check between TP11 and TP1 for the correct signal voltage, either a 0 to 1 volt DC reading if the valve is supposed to be open, or 10 to 12 volts if the valve should be closed.
- ◆ If TP11 shows an incorrect signal, this would indicate a control problem [see sec. 7.20].
- ◆ Check for a shorted black wire going to the Solenoid Coil.
- ◆ Remove the Solenoid Coil and check for a short in the Solenoid Coil [see sec. 8.3].
- ◆ Remove the connection box from the Solenoid Coil and check that the connectors are in place and making good contact with the terminals on the Solenoid Coil [see sec. 8.3].

### **7.25.4 Water leaks back at the end of the Exhaust cycle**

- ◆ The Reservoir may be overfilled.
- ◆ There may be a pinhole in the body of the Cooling Coil allowing water to siphon back.
- ◆ The open end of the Cooling Coil, in the water Reservoir, may be below the water line. Reaching into the Reservoir and holding down the body of the coil, while pulling up on and stretching the neck of the coil can easily correct this.
- ◆ Some EA, EKA, EZ and EZ10k machines have a different Cooling Coil and a Check Valve to protect against this situation. The Check Valve is located next to the Reservoir in the exhaust line. If suck back is occurring during the Dry Cycle or normal cool down, replace the Check Valve.

## 7.26 Cut-Out Thermostat Problems

**Note: The Cut-Out Thermostat is factory calibrated. It should not be adjusted in the field.**

### 7.26.1 Red reset button will not reset

- ◆ Make sure the Chamber has cooled. If the Chamber remains hot the Cut-Out Thermostat cannot be reset.
- ◆ Use a sharp pointed object, like the point of a pencil or pen to fully depress the reset button, if necessary. When reset, a small click can be detected, the button, however, may not stay in.
- ◆ If power is not restored to the autoclave, unplug the unit and remove the two power wires going to the Cut-Out Thermostat. Use an ohmmeter to check continuity across the terminals.
- ◆ If continuity cannot be restored across the terminals of the Cut-Out Thermostat by pushing in the red reset button, replace the Cut-Out Thermostat [see sec. 10.2].

### 7.26.2 Reset button is always tripping

- ◆ Check that the unit is receiving the correct voltage [see sec. 2.3].
- ◆ Check that the Water Sensor is clean [see sec. 6.6].
- ◆ Check that the autoclave is filling with the correct amount of water [see sec. 8.6].
- ◆ Check that the Cut-Out Thermostat is installed correctly [see sec. 10.2].
- ◆ Check that the autoclave is not leaking water or steam [see sec. 7.16].
- ◆ Check that the temperature setting is no higher than 273°F (134°C) [see sec. 5.3].
- ◆ Replace the Cut-Out Thermostat [see sec. 10.2].

### 7.26.3 There is no continuity across the Cut-Out Thermostat

- ◆ To correctly check continuity, unplug the unit and remove the two power wires from the Cut-Out Thermostat; use an ohmmeter to check across the terminals for continuity.
- ◆ Make sure the Chamber has cooled. If the Chamber remains hot the Cut-Out Thermostat cannot be reset.
- ◆ Push in the small red reset button on the Cut-Out Thermostat. It may be necessary to use a sharp pointed object, like the point of a pencil or pen to fully depress the reset button.
- ◆ If continuity cannot be restored across the terminals of the Cut-Out Thermostat by pushing in the red reset button, replace the Cut-Out Thermostat [see sec. 10.2].

#### **7.26.4 Cut-Out Thermostat does not turn off power to the Autoclave**

- ◆ The sensing probe should be installed in the upper channel of the rear most Heating Element [see sec. 10.2].
- ◆ The sensing probe must have a tight fit [see sec. 10.2].
- ◆ The tubing connected to the probe must not be kinked in any way [see sec. 10.2].
- ◆ Check the Heating Elements for a ground short [see sec. 8.2].
- ◆ Replace the Cut-Out Thermostat [see sec. 10.2].



## 7.27 Water Pump Problem

### 7.27.1 Pump does not turn on

Only units with Microprocessors that have a version number containing the letters **WP** will have a Water Pump installed.

- ◆ Check the Water Pump Fuse with an ohmmeter, if needed, replace with a 1.2 amp fuse. The Water Pump Fuse is located above the Circuit Breaker or the two line voltage Fuses at the back of the autoclave.
- ◆ Check for a pinched wire or other open in the power leads going from the Water Pump SSR (Solid State Relay) to the Water Pump.
- ◆ The Water Pump SSR is located in the Electronic Box.
- ◆ Terminals 1 and 2 are on the high voltage side of the SSR that supplies power to the Water Pump.
  - Turn the power off; remove the wires connected to terminals 1 and 2 of the Water Pump SSR. Connect these two wires together and turn the power back on.
  - If the Water Pump does not run:
    - ❖ Check that there is power between the wire on terminal 1 and ground.
    - ❖ Turn the power off and check continuity from the wire on terminal #2, through the Molex connector pin 11 to the Water Pump.
    - ❖ Check continuity from the return wire on the Water Pump to the return side of the Circuit Breaker.
    - ❖ If the SSR has power and there is continuity to and from the Water Pump, the problem is with the pump and it should be replaced [see sec. 10.22].
  - If the pump does run, the problem is with either the Water Pump SSR or the control circuit.
- ◆ Check if the Water Pump SSR is being told to turn on. With a DVM read between TP13 and TP1, on the test point board, a 0 to 1 volt DC signal tells the Water Pump SSR to turn on and 10 to 12 volts tells it to turn off. An incorrect signal would indicate a problem with the control circuit [see sec. 7.20].
- ◆ If the control signal is correct at the test point, check if the correct signal is at the Water Pump SSR.
  - Terminals 3 and 4 are on the control side of the SSR and are connected to JP15 on the Ajunc board.
  - A reading across terminals 3 and 4 should show 10 to 12 volts DC for the Water Pump SSR to be turned on and 0 to 1 volt if it should be off [see sec. 8.1].
  - If the control signal is not correct at the Water Pump SSR, the problem is with the Ajunc board and it should be replaced [see sec. 10.18].

### 7.27.2 Pump does not turn off

- ◆ Check if the Water Pump SSR is being told to turn off. With a DVM read between TP13 and TP1, on the test point board, a 10 to 12 volt DC signal tells the Water Pump SSR to turn off and 0 to 1 volts tells it to turn on. An incorrect signal would indicate a problem with the control circuit [see sec. 7.20].
- ◆ If the control signal is correct at the test point, check if the correct signal is at the Water Pump SSR.
  - Terminals 3 and 4 are on the control side of the SSR and are connected to JP15 on the Ajunc board.
  - A reading across terminals 3 and 4 should show 10 to 12 volts DC for the Water Pump SSR to be turned on and 0 to 1 volt if it should be off [see sec. 8.1].
  - If the control signal is not correct at the Water Pump SSR, the problem is with the Ajunc board and it should be replaced [see sec. 10.18].

### 7.27.3 Water Pump blows fuse

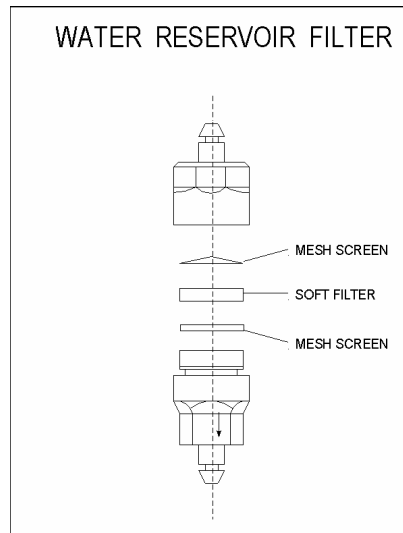
- ◆ Check for a pinched wire or other ground short in the power leads going from the Water Pump Fuse to the Water Pump.
- ◆ Turn off the power and disconnect the wires from the Water Pump and turn the power back on.
  - If the fuse blows again the problem is with a shorted wire.
  - If the fuse does not blow the problem is with the Water Pump or the pump capacitor and both should be replaced [see sec. 10.22].

### 7.27.4 Pump makes noise

- ◆ Check if the Water Pump mounting bracket is loose or broken.
- ◆ Replace the pump bracket.
- ◆ If the pump bracket is not loose or broken, replace the Water Pump [see sec. 10.22].

### 7.27.5 Pump does not pump water

- ◆ Is the Pump Strainer clogged?  
It is recommended that you remove and discard the soft white filter, if it is present.



Part No. FIL175-0020

- ◆ Clean the Pump Strainer and run the Water Pump using the **Water Inlet Key**. If water is now being pumped, the problem was a clog in the Pump Strainer.
- ◆ Check if the Fill Solenoid is being activated. Place a steel object like a screwdriver on the center post of the Fill Solenoid to detect a magnetic field.
  - If a magnetic field is detected, the solenoid has been turned on.
  - If no magnetic field is detected [see sec. 8.3].
- ◆ Listen for a click at the Fill Solenoid when the Water Pump turns on.
  - A click will indicate that the solenoid should be open.
  - If there is no click, [see sec. 8.3].
- ◆ Open the Fill Solenoid Valve, remove the plunger and reinstall the housing only. Press the **Water Inlet Key**.
  - If water is pushing through to the Chamber, the problem is with the Plunger.
  - If not, remove the housing. Again press the **Water Inlet Key**.
  - If water is pushing through to the valve base, the problem is in the tubing from the valve base to the Chamber.
  - If the water is not pushing through to the valve, the problem is with the tubing from the base to the pump or the Water Pump itself.
  - Replace the pump if necessary.

### 7.27.6 Water flows in the wrong direction

Reverse the two silicone tubes connected to the Water Pump.

## 8 Testing and Calibration

### 8.1 SSR (Solid State Relay)

- ◆ Unplug the unit.
- ◆ Remove the Outer Cabinet.
- ◆ Label and then remove the four wires connected to the SSR. Using an ohmmeter, check for a short circuit between terminals 3 & 4 and 1 & 2 and 3 & 1 and 4 & 2 and 3 & 2 and 4 & 1. Make sure there are no direct shorts. If a direct short is found in the SSR, replace it [see sec. 10.8].
- ◆ Next, using an ohmmeter, check for an open between terminals 1 & 2. Be sure to reverse the meter leads and check in the opposite direction. Repeat the procedure for terminals 3 & 4. If an open is found, replace the SSR [see sec. 10.8].
- ◆ Reconnect the wires to the four connectors of the SSR.
- ◆ If checking the Heat SSR, make sure that dip switch 4 (on the Digital Predg Board) is in the off or down position:
  - Plug the unit in.
  - Turn the unit on.
  - Make sure the autoclave is sitting idle with no cycle running. If necessary, abort any cycle that may not have been completed.
- ◆ Take a DC voltage reading from terminal 3 on the Solid State Relay to ground.
  - If checking the Heater or Dry Pump circuit, both devices should be in the **OFF** mode and there should be a voltage reading between +3.5 and +5 volts DC.
  - If checking the Water Pump circuit, this device should also be in the **OFF** mode, with a voltage reading between +10.5 and +12 volts DC.
  - Repeat this procedure with terminal 4 and you should have the same reading. A good reading indicates that the SSR is not turned on.
  - If terminal 3 does not read between +3.5 and +5 or +10.5 and +12 volts DC, check if the Power Supply is properly supplying these voltages.
  - If terminal 4 does not read the correct voltage, unplug the unit and remove the wire on terminal 4.
  - Turn the power back on and recheck terminal 4.
  - If the reading is still not correct, replace the SSR.
  - If the reading is correct, check continuity between the terminal #4 wire and the appropriate connector; unplug the unit when taking this reading.
    - JP4 if checking the Heater SSR.
    - JP15 if checking the Water Pump SSR.
    - JP16 if checking the Dry Pump SSR with an Ajunc 3 board.
    - JP9 if checking the Dry Pump SSR with an Ajunc 2 board.
  - If continuity checks out, there is a Control Problem [see sec. 7.20].
- ◆ With the Heaters or the Dry Pump **ON** and running, there should be a reading between +3.5 and +5 volts DC from terminal 3 to ground and a reading between 0 and 1 volt DC from terminal 4 to ground.

- ◆ With the Water Pump **ON** and running, there should be a reading between +10.5 and +12 volts DC from terminal 3 to ground and a reading between 0 and 1 volt DC from terminal 4 to ground.
  - If the reading at terminal 4 does not show a reading of between 0 and 1 volt when the Heaters or Dry Pump are **ON**, check continuity between terminal 4 and the appropriate Ajunc board connector.
  - If the reading at terminal 4 does not show a reading of between 0 and 1 volt when the Water Pump is **ON**, check continuity between terminal 4 and the appropriate Ajunc board connector.
  - If continuity is good, there is a Control Problem [see sec. 7.20].
  - If the reading at terminal 4 is between 0 and 1 volt and the SSR is on. The control side of the SSR is okay and the problem may be on the load side.

### **For 110 volt units**

- ◆ Turn the unit on and the device being tested should be in the **OFF** mode.
- ◆ Terminal 2 of the Solid State Relay should read between 110 and 125 volts AC to ground.
- ◆ Terminal 1 should read near 0 volts AC to ground. Reading across terminals 1 & 2 should show between 110 and 125 volts.
  - If terminal 2 does not read between 110 and 125 volts to ground, there is a problem with the line voltage wiring going to the SSR.
  - If terminal 1 shows the same voltage as terminal 2, replace the SSR.
  - If there is a voltage reading less than 100 volts across terminals 1 & 2, replace the SSR.
- ◆ Turn the unit on and the device being tested should be in the **ON** mode.
  - Terminals 1 and 2 should each read between 110 and 125 volts to ground.
  - Reading across terminals 1 and 2 should show close to 0 volts.
  - If terminal 2 does not show between 110 and 125 volts to ground, there is a problem with the line voltage wiring to the SSR.
  - If terminal 1 does not show between 110 and 125 volts to ground, replace the SSR.
  - If the reading across terminals 1 & 2 is greater than 1 or 2 volts, replace the SSR.

### **For 220 volt units**

- ◆ Turn the unit on and the device being tested should be in the **OFF** mode.
- ◆ Terminal 1 of the Solid State Relay should read between 110 and 125 volts AC to ground.
- ◆ Terminal 2 of the Solid State Relay should read between 110 and 125 volts AC to ground.
- ◆ A reading across terminals 1 & 2 should show between 220 and 235 volts.
  - If terminals 1 and 2 do not each read approximately 110 volts to ground, there is a problem with the line voltage wiring going to the SSR.
  - If a voltage of between 220 and 235 volts is not present across terminals 1 & 2, unplug the unit and remove the wires. Plug the unit back in and carefully take a reading across the wires.

- If a voltage between 220 and 235 is present across the unconnected wires, the SSR needs to be replaced.
- If the voltage is still incorrect, the problem is with the line voltage wiring going to the SSR.
- ◆ Turn the unit on and the device being tested should be in the **ON** mode.
- ◆ Terminal 1 of the Solid State Relay should read between 110 and 125 volts AC to ground.
- ◆ Terminal 2 of the Solid State Relay should read between 110 and 125 volts AC to ground.
- ◆ A reading across terminals 1 & 2 should show a voltage near 0 volts AC.
  - If terminals 1 & 2 do not read approximately 110 volts to ground, there is a problem with the line voltage wiring going to the SSR.
  - If the voltage reading across terminals 1 and 2 is higher than 5 volts, replace the SSR.

## 8.2 Testing Heating Elements

After unplugging the unit, remove the cover. Without removing any wires from the Heating Elements, take an ohm reading across the two terminals of any one Heating Element. Since the elements are all wired together, you will be reading all of the elements as a group. If the group has a good reading, all the elements are good. To determine if the reading is good, use the following procedure:

Using the Ohm & Amp Readings Table [see sec. 9.1], locate the model of the sterilizer and compare your reading with that of the chart. The values from your meter can be + or – 10 % when compared to the table, any greater deviation and the elements will need to be checked individually. After the initial reading across the terminals, a ground reading needs to be taken.

To take a ground reading, again leave all the wires attached, check from one terminal of any heating element to chassis ground. Ideally when checking to ground, there should be no reading at all. However, a reading of 10-12 Meg ohms is the lowest that would be acceptable and the heating elements still be considered good.

If the Heating Elements fail either one of these group tests, the Heating Element wires need to be removed and each element retested individually for both ohms and ground. The Ohm & Amp Readings Table has a separate column for individual heating element values and sec. 10.1 explains replacement of the Heating Elements.

Remember, when removing or installing wires on the Heating Elements always hold the terminal with a pair of pliers. This will avoid internal damage to the element from twisting the terminal.

## 8.3 Solenoid Valves

### 8.3.1 Electrical Checks

- ◆ The easiest test to tell if the Solenoid is active is to take a steel or iron object and touch it to the center post of the Solenoid Valve assembly. If the metal object is magnetically attracted to the post, it can be concluded that the coil has been energized.
- ◆ If the valve is operating intermittently or not at all, turn off the autoclave and remove the connection box from the Solenoid Coil. Disassemble the connection box and check that the connectors are solidly in place and making good contact with the terminals on the Solenoid Coil.
- ◆ While the connection box is disassembled, check that the orange or black wires are not broken or loose.
- ◆ Reinstall only the inner assembly of the connection box onto the Solenoid.
- ◆ Turn the unit back on and monitor the voltage across the terminals.
- ◆ When the Solenoid is off, there should be between 0 and 1 volt DC across the terminals.
- ◆ When the **Solenoid** is on, there should be between 10.5 and 12 volts DC across the terminals.
- ◆ If the **voltages** are not correct, remove the inner assembly from the coil and check again.
- ◆ If the voltages remain incorrect, check for a damaged wire or loose JP2 connector.
- ◆ If the problem is still not resolved, check for a control problem [see sec. 7.20].
- ◆ If the problem clears up when the coil is disconnected, take an Ohm reading on the Solenoid Coil. The reading across the two side terminals should be between 14–15 ohms for a 10 Watt solenoid coil or 9–10 ohms for a 12 Watt solenoid coil.

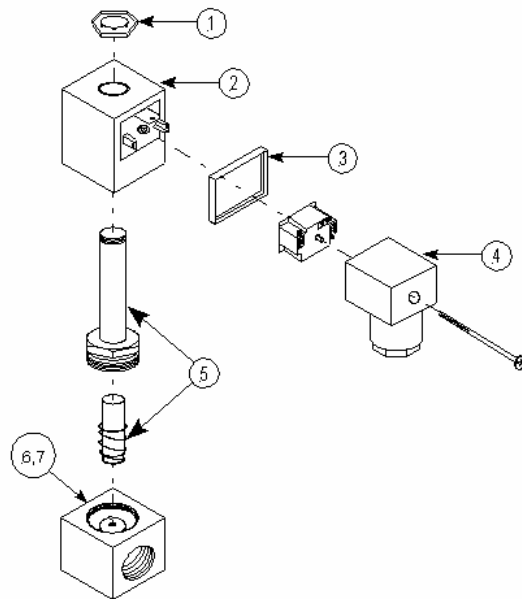
There should be **no** continuity from either of the side terminals to the center terminal.

- ◆ If a problem is found with the coil, it should be replaced.

**Note: The voltage readings at the connection box on solenoids will be the reverse of what is at the test points.**



## SOLENOID VALVES



ITEM	PART NO.	DESCRIPTION
1.	01810908	SOLENOID NUT
2.	01810907	SOLENOID 110 VOLTS/8 WATTS (PRE 1991)
	01810102	SOLENOID 12 VOLT/10 WATTS (1991 & ON)
	01810905	SOLENOID 12 VOLT/12 WATTS (1991 & ON)
3.	01810910	SOLENOID GASKET
4.	01810909	SOLENOID WIRE CONNECTOR
5.	01810903	PLUNGER VALVE 3MM FOR EXHAUST, AIR OUTLET & DRY PUMP VALVES
	01810904	PLUNGER 6MM FILL VALVE
6, 7	01810103	VALVE ASSEMBLY COMPLETE 6MM FOR WATER FILL VALVES
	01810101	VALVE ASSEMBLY COMPLETE 3MM FOR AIR OUTLET, EXHAUST & DRY PUMP VALVES

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### 8.3.2 Mechanical Checks

- ◆ Remove the Solenoid Coil.
- ◆ Unscrew the Plunger Assembly from the base.
- ◆ Clean as necessary.
- ◆ Check the sleeve of the Plunger for any nicks or distortions that can cause the Plunger to become stuck.
- ◆ Ensure that the Plunger is able to move in and out of the sleeve freely, if not, replace the Plunger Assembly.
- ◆ Check the seat of the Plunger for any irregularities, replace as necessary.
- ◆ Check the seat in the base of the valve assembly with a magnifying glass, for any irregularities, replace as necessary.

## 8.4 Temperature Sensor Calibration

There are two procedures, depending on which Ajunc board is in the system.

### 8.4.1 For systems with an Ajunc 2 board

This procedure needs to be done anytime the LM34 Temperature Sensor, the LM34 Replacement Sensor or the Digital Predg Board is changed.

- ◆ The unit should be on but not running a cycle.
- ◆ Connect one lead of a DC voltmeter to the bottom leg of the **R13** resistor, located on the Digital Predg Board.
- ◆ Connect the other lead to ground (chassis ground is okay).
- ◆ Monitor the voltage and adjust the **R20** pot located on the Digital Predg Board so that the meter reads:
  - 300 mv if the unit has an LM34 installed.
  - 320 mv if the unit has an LM34 Replacement installed.
- ◆ If an LM34 Replacement is installed, a fine-tuning adjustment can be made using the adjustment pot on the small circuit board that is part of the LM34 Replacement cable [see sec. 10.3].
  - Using a good reference device, run a standard sterilization cycle and adjust the pot to correct the digital display on the autoclave.
- ◆ If the temperature reading on the display is still incorrect, check the voltage between TP5 and TP1 on the Ajunc 2 Board. The reading at this point will be equal to 0.01 volts DC multiplied by the temperature of the Chamber. For example, if the Chamber is at a room temperature of 72°F, the reading at TP5 will be 72 degrees x 0.01 volts or 0.72 volts.
- ◆ If the reading at TP5 appears good, run a standard sterile cycle and monitor TP5; the readings should rise at the rate of 0.01 volts per degree. If these readings are not good, replace the LM34 Temperature Sensor [see sec. 10.3].
- ◆ If the Temperature Sensor is good, the problem is in either the Digital Predg Board or the cable connection between the Ajunc 2 Board and the Digital Predg Board. Replace either the cable or the Digital Predg Board or both.
- ◆ While there are no components on the Ajunc 2 Board that are used for the temperature circuit, it is possible that there could be a bad solder joint on the Ajunc 2 Board. The normal path of the signal will be to come into the Ajunc 2 Board and go directly to the Digital Predg Board through the connecting cable. A bad solder joint is usually detectable by putting pressure on the connector on the back of the Ajunc 2 or the main cable going to the Digital Predg Board. If applying pressure causes a change in the readings, a connection problem can be suspected, and in this case, changing the Ajunc 2 Board is recommended.

#### 8.4.2 For systems with an Ajunc 3 board

##### There are two methods for performing this calibration

This procedure needs to be done anytime the PT-100 Temperature Sensor or Ajunc 3 Board is changed.

- ◆ Disconnect the temperature sensor from the JP11 connector on the back of the Ajunc 3 Board and proceed with either method.
- ◆ The unit should be on but not running a cycle.

- ◆ **Method 1:** Using the PT-100 Simulator (preferred).

- Connect the PT-100 simulator to the JP11 connector.
- Select 32°F (0°C) on the simulator.
- Connect the negative probe of your meter to TP25 and the positive probe to TP26.
- Adjust Pot 4 on the Ajunc 3 so your meter reads -5.1 mv DC (negative 5.1 mv DC).
- Select 273°F (134°C) on the simulator.
- Connect the negative probe of your meter to TP1 and the positive probe to TP7.
- Adjust Pot 5 so your meter reads **2.385 volts DC**.
- If it is not possible to adjust Pot 4 to -5.1mv, replace the Ajunc 3 board.
- If it is not possible to adjust Pot 5 to the correct voltage, replace the Ajunc 3 board.

- ◆ **Method 2:** Using 100 and 151 ohm resistors

- Connect a resistor of a 100-ohm value to the JP11 connector.
- Connect the negative probe of your meter to TP25 and the positive probe to TP26.
- Adjust Pot 4 of the Ajunc 3 so your meter reads -5.1 mv DC (negative 5.1 mv DC).
- Remove the 100-ohm resistor and connect a resistor of a 151-ohm value to the JP11 connector.
- Connect the negative probe of your meter to TP1 and the positive probe to TP7.
- Adjust Pot 5 so your meter reads **2.366 volts DC**. (See note at the end of this section)
- If it is not possible to adjust Pot 4 to -5.1mv, replace the Ajunc 3 board.
- If it is not possible to adjust Pot 5 to the correct voltage, replace the Ajunc 3 board.

◆ **Testing the calibration:**

- Leave the PT-100 Simulator connected to JP11 with 273°F selected.
- Run the In / Out Test (see sec. 8.13).
- Select the PT-100 test.
- If the display does not read 273°F +/- 2°F, replace the Digital Predg Board.
- Reconnect the PT-100 Temperature Sensor and run an empty sterilization cycle.
- If the digital display does not show the correct temperature, replace the PT-100 Temperature Sensor [see sec. 10.3].

**Note:** The adjustment voltage that Pot 5 is adjusted to is dependent on the value of the resistor inserted into JP11.

- ◆ If a PT-100 Simulator or a 151-ohm resistor is not available, obtain a resistor with a value as close as possible to 151-ohms. Using the following formula, recalculate the adjustment voltage for the Pot 5 adjustment when using this new resistor value:

$$[(\text{New resistor} - 100) / 51.4] \times 2.385 = \text{voltage to adjust Pot 5}$$

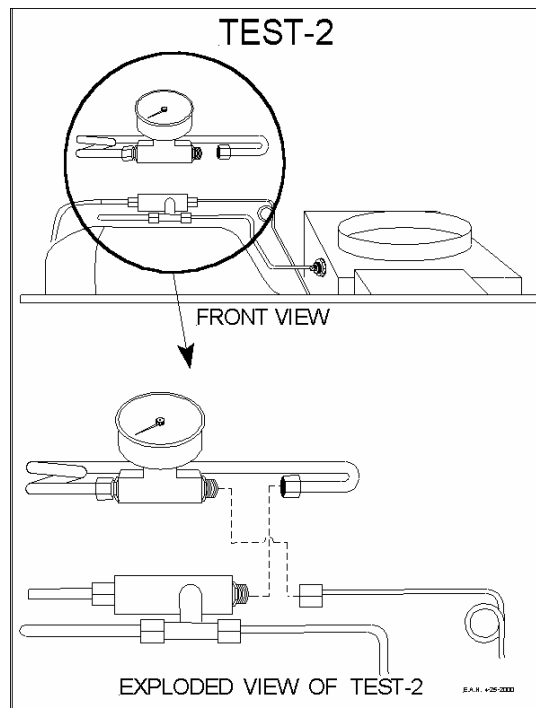
## 8.5 Pressure Sensor Calibration

There are two procedures; depending on which Ajunc board is in the system.

### 8.5.1 For units with an Ajunc 2 board

This procedure needs to be done anytime either the MPX201 Pressure Sensor or the Ajunc 2 Board is replaced.

- ◆ The autoclave should be on, but not running a cycle.
- ◆ The Zero Adjustment is done first
  
- ◆ **Zero Adjustment Procedure**
  - Connect a voltmeter to TP2 and TP3 on the Ajunc 2 Board.
  - Adjust Pot 1 on the Ajunc 2 Board for 0 volts DC.
  - If this adjustment cannot be made, replace the Pressure Sensor or Ajunc 2 Board in that order [see sec. 10.4 or sec. 10.18].
  
- ◆ **Gain Adjustment Procedure**
  - Connect a known accurate mechanical gauge (Tuttnauer part # Test-2) in line with the Pressure Sensor.
  - A good place for this connection would be at the upper rear manifold.
  - Open the connection that leads to the Pressure Sensor.
  - Insert the mechanical gauge and tighten all fittings.



- Run an empty sterilization cycle and adjust Pot 2 so the digital display matches the mechanical gauge.
- Wait until the reading on the pressure gauge has passed 25 psi to make the final adjustment.
- If the display is still incorrect or inconsistent, connect a voltmeter across TP4 and TP1 (negative probe) on the Ajunc 2 Board.
- Run an empty sterilization cycle.
- The meter should show a voltage reading rising from 0 volts to 1.923 volts DC. This voltage reading corresponds to a pressure reading of between 0 psi and 30 psi. While the cycle is running it can be observed that each one pound change in pressure is approximately equal to 64.1 mv.
- If the readings obtained are not correct, replace the Pressure Sensor or Ajunc 2 Board in that order [see sec. 10.4 or sec. 10.18].
- If the readings are correct but the display is still inaccurate, replace the Digital Predg Board [see sec. 10.19].

### **8.5.2 For units with an Ajunc 3 board**

This procedure needs to be done anytime either the MPX2200 Pressure Sensor or the Ajunc 3 Board is replaced.

- ◆ The autoclave should be on, but not running a cycle.
- ◆ The Gain Adjustment is done first.

#### **◆ Gain Adjustment Procedure**

- Connect a voltmeter across TP4 and TP1 (negative probe).
- Adjust Pot 2 on the Ajunc 3 Board so the meter reads 500 mv DC (+/-5mv).
- If this adjustment cannot be made, replace the Pressure Sensor or Ajunc 3 Board in that order [see sec. 10.4 or sec. 10.18].
- If the display is still incorrect or inconsistent, connect a voltmeter across TP4 and TP1 (negative probe) on the Ajunc 3 Board.
- Run an empty sterilization cycle.
- The meter should show a voltage reading rising from 500 mv to 1.5 volts DC. This voltage reading corresponds to a pressure reading of between 0 psi and 30 psi. While the cycle is running it can be observed that each one pound change in pressure is approximately equal to 33.3mv.
- If the readings obtained are not correct, replace the Pressure Sensor or Ajunc 3 Board in that order.
- If the readings are correct but the display is still inaccurate, replace the Digital Predg Board.

◆ **Zero Adjustment Procedure**

- Turn the autoclave off.
- Press and hold in the Door Switch.
- Turn the power on and hold the Door Switch for 5 seconds.
- The autoclave can compensate for any inaccuracy in the Zero display up to 10%.
- If this adjustment cannot be made, replace the Pressure Sensor or Ajunc 3 Board in that order [see sec. 10.4 or sec. 10.18].

## 8.6 Automatic Water Fill Procedure

### 8.6.1 Adjusting the Chamber pitch

- ◆ Start with a sturdy, level counter.
- ◆ Make sure all the feet are on the autoclave and none have been lost.
- ◆ Make sure the front feet are free to move in and out.
- ◆ Position the autoclave on the counter.
- ◆ For all units with Microprocessors containing the letters **WP** at the end of the software version number (ex. T97DN7WP), skip to **sec. 8.6.4**, for all other units continue on.
- ◆ The Chamber should be empty of any instruments, trays or leftover water.
- ◆ The autoclave should be turned off.
- ◆ Measure out the proper amount of water for the appropriate model unit as listed below:

1730	= 10 oz. (300ml)
2340	= 14 oz. (400ml)
2540	= 14 oz. (400ml)
3140 (3545)	= 17 oz. (500ml)
3850	= 24 oz. (700ml)
3870	= 29 oz. (850ml)

**All water volumes can be +2 oz and – 0 oz**

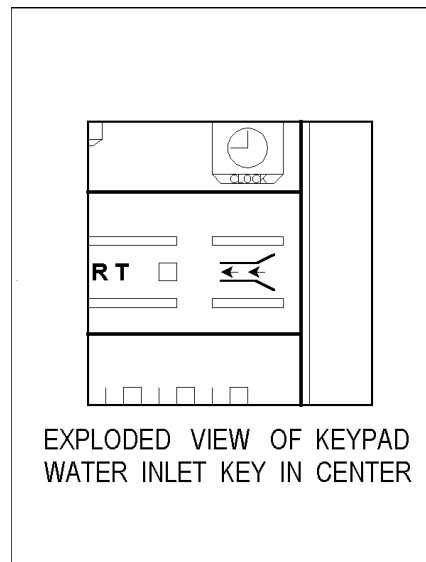
- ◆ Pour the proper amount of water into the Chamber through the front door of the unit.
- ◆ This water should cover the bottom of the Chamber to within +/- ½ inch of the grove in the front.
- ◆ If necessary, adjust the front Leveling Feet so that the water lays in the Chamber correctly.
- ◆ Once the Chamber pitch adjustment is completed, empty the water from the chamber and proceed to the next section 8.6.2.

### 8.6.2 Automatic Filling Adjustment Procedure

- ◆ Make sure the power is off.
- ◆ The Door should be open.
- ◆ Press and hold the **Water Inlet Key**, (this is the button on the front Keypad with the two arrows).
- ◆ Turn the power on.
- ◆ When the normal display screen appears, release the **Water Inlet Key** – wait one second and press it in again.



- ◆ Water should begin flowing into the Chamber.
- ◆ Monitor the water flow into the Chamber.
- ◆ Hold the **Water Inlet Key** until water reaches the groove at the front.
- ◆ Release the button; wait ten seconds, the unit is now reprogrammed.



### 8.6.3 Checking the Automatic Fill

To check if the automatic filling procedure was accepted, follow the next few steps:

- ◆ Empty any water that is in the Chamber.
- ◆ With the Door open, press and hold the Door Switch, press the **START Key**.
- ◆ When water starts flowing into the Chamber, release the Door Switch.
- ◆ Water should come up to the same spot as the programmed amount had.
- ◆ For units with Water Pumps and Microprocessors that contain the letters **WP** at the end of the software version number (ex. T97DN7WP), the water filling the Chamber will be greater than the amounts listed in sec. 8.6.1. Be prepared to catch this extra water in a bucket.
- ◆ When the unit has finished filling, measure all the water in the Chamber and in the bucket, it should be equal to or greater than the amounts listed in sec. 8.6.1.
- ◆ If the water fill is not working correctly, try the adjustment procedure again or check for a system problem [see sec. 7.15].

#### 8.6.4 Automatic Filling for units with Water Pumps

Any unit with a Microprocessor software version number ending in **WP** will have a Water Pump installed to insure proper filling.

To calibrate the automatic fill, follow this procedure:

- ◆ Press the **STOP Key** repeatedly until the message “Code: xxx” appears.
- ◆ Using the **UP/DN** arrow keys, change the code to 105, press the **STOP Key**.
- ◆ A message will be displayed saying “Water in = xx sec”.
- ◆ Using the **UP/DN** arrow keys change the seconds according to the following table:

2340	=	30 sec
2540	=	35 sec
3140	=	40 sec
3850	=	45 sec
3870	=	65 sec

- ◆ Press the **STOP Key**.
- ◆ In some models, the message “Ea Type:” will appear; using the **UP/DN** arrow keys select either “0” for an E or EK type unit or “1” for an EA or EKA type unit.
- ◆ Press the **STOP Key** to finish.

## 8.7 Water Sensing Electrode Testing

Testing can be done in two ways

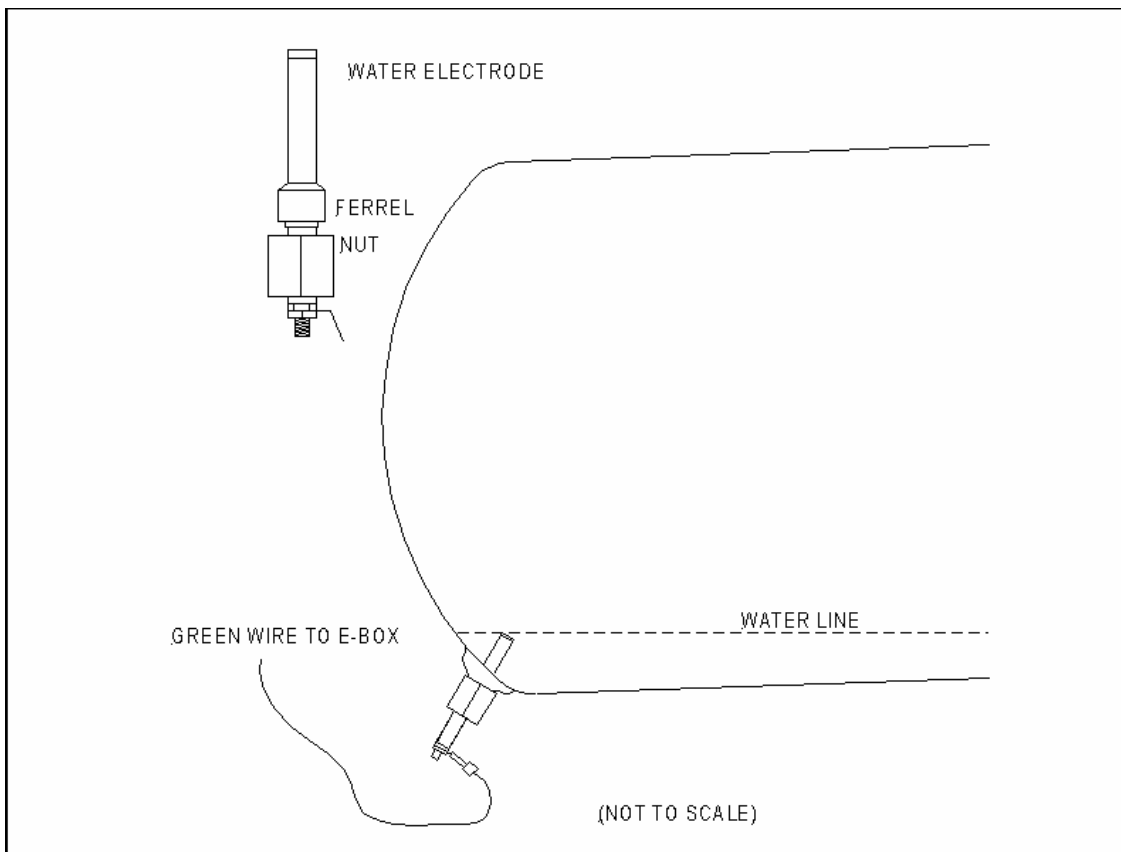
### 8.7.1 Testing the Electrode from the test points

- ◆ Connect a voltmeter to TP1 (ground) and TP6 on the Ajunc Board.
- ◆ Set the meter to read DC volts.
- ◆ With no water in the Chamber, the meter should read between 0 and 1 volt DC.
- ◆ If the meter shows a higher voltage, there is a problem with the circuit and each part should be checked.
  - Test the Electrode independently [see sec. 8.7.2 below].
  - Make sure the wire connection from the Electrode to the Ajunc Board is in good condition.
  - If the Electrode checks out good and the wiring is good, there is a control problem [see sec. 7.20].
- ◆ Fill the Chamber with water either by holding the Manual Fill Button or by pouring water in through the front Door.
- ◆ Once water is touching the tip or the Electrode continuously, the meter will read between 3.5 and 5 volts DC.
- ◆ If the voltage reads between 3.5 and 5 volts DC before the water reaches the tip, there is a problem with the sensor. Replace the sensor [see sec. 10.10].
- ◆ If the meter reading does not change correctly, there is a problem with the circuit and each part should be checked.
  - Test the Electrode independently [see sec. 8.7.2 below].
  - Make sure the wire connection from the Electrode to the Ajunc Board is in good condition.
  - If the Electrode checks out good and the wiring is good, there is a control problem [see sec. 7.20].
- ◆ If the test is successful, it confirms that the Electrode is working correctly, that the Ajunc Board is working correctly and that the wire connection between the Electrode and the Ajunc Board is good.

### 8.7.2 Testing the Electrode with an ohmmeter

- ◆ Push up the insulation blanket at the rear of the Chamber.
- ◆ Locate the back end of the Electrode.
- ◆ Remove the small green wire connected to the Electrode.
- ◆ Connect an ohmmeter to the tab of the Electrode and the Chassis.
- ◆ With no water in the Chamber, the meter will show an open circuit.
- ◆ If the meter reads continuity before the water reaches the tip, there is a problem with the sensor. Replace the sensor [see sec. 10.10].

- ◆ Fill the Chamber with water either by holding the Manual Fill Button or by pouring water in through the front Door.
- ◆ Once water is touching the tip of the Electrode continuously, the meter should read continuity.
- ◆ This test confirms that the Electrode is in good condition and working properly.
- ◆ Be sure to replace the small green wire on the back of the Electrode.



## 8.8 Temperature Safety Thermostat Testing

### 8.8.1 Testing Overview

The Temperature Safety Thermostat is an automatic resetting device. Proper testing for the Temperature Safety Thermostat begins with determining if the device is hard wired to the Heating Elements or if it is wired to the Microprocessor.

Temperature Safety Thermostats in units with Microprocessors having software versions before T93N5 will be wired for direct control of either the 110 or 220 volts going to the heaters.

Temperature Safety Thermostats in units with Microprocessors having software versions after and including T93N5 will be wired to control a signal going to the Microprocessor.

Under normal conditions the contacts in the Temperature Safety Thermostat are closed, completing the circuit it is in. When an overheating occurs, the Temperature Safety Thermostat opens and the circuit is now broken. Once the autoclave cools, the Temperature Safety Thermostat will reset itself.

**This thermostat is installed on the autoclave to act as a safety device that detects overheating problems. When it becomes activated, do not automatically assume it is defective. Check out the autoclave thoroughly. If no other problem is found that could be causing this thermostat to be activated, then and only then change this device**

**Do Not** attempt to adjust this device. This thermostat is set at the factory in a special kiln. If you attempt to field adjust it you will be setting it to the wrong temperature, you may damage the device, the autoclave and the contents of the Chamber as well as voiding the warranty.

### 8.8.2 Testing if the device does not reset

- ◆ Unplug the unit.
- ◆ Disconnect the two wires going to the Temperature Safety Thermostat and take an ohm reading across the two terminals. You should be reading a closed circuit. Take into account that a hot autoclave will delay the resetting of the Temperature Safety Thermostat.
- ◆ If the autoclave is not hot and the device has not automatically reset, replace the Temperature Safety Thermostat.

### 8.8.3 Testing if the device trips too soon

- ◆ If the Temperature Safety Thermostat is hard wired to the Heating Elements:
  - Unplug the unit and remove the two wires.
  - Connect the two wires together.
  - Connect an ohmmeter across the two empty terminals of the Temperature Safety Thermostat.
  - Plug the unit in and run several cycles.
  - The ohmmeter should show a closed circuit.
  - If the ohmmeter shows an open circuit and no problem can be found that would cause overheating in the autoclave, replace the Temperature Safety Thermostat.
  
- ◆ If the Temperature Safety Thermostat is wired to the Microprocessor **and** the unit has an Ajunc 2 Board:
  - Connect a meter to the **small** green wire on the Temperature Safety Thermostat. Make sure that the small green wire is still connected to the thermostat terminal.
  - Connect the other meter lead to the Chassis.
  - The meter should be set for DC volts.
  - Turn the unit on.
  - The meter should read between 0 and 1 volt DC while the unit is running.
  - If the meter shows a reading between 3.5 and 5 volts and there is no indication or reason for the autoclave to be overheating, replace the Temperature Safety Thermostat.
  
- ◆ If the Temperature Safety Thermostat is wired to the Microprocessor **and** the unit has an Ajunc 3 Board:
  - Connect a meter across TP22 and TP1.
  - The meter should be set for DC volts.
  - Turn the unit on.
  - The meter should read between 0 and 1 volt DC while the unit is running.
  - If the meter shows a reading between 3.5 and 5 volts and there is no indication or reason for the autoclave to be overheating, replace the Temperature Safety Thermostat.
  
- ◆ To further test a unit where the Temperature Safety Thermostat is connected to the Microprocessor and also has an Ajunc 3 Board:
  - Turn the unit on.
  - Connect a voltmeter between TP22 and TP1.

- Remove the thin green wire that connects the Temperature Safety Thermostat to the Microprocessor and make sure that the JP2 connector on the back of the Ajunc 3 Board is connected properly.
- Ground the green wire by touching it to the Chassis.
- The reading at TP22 should change from between 3.5 and 5 volts to between 0 and 1 volt DC and return to between 3.5 and 5 volts when the ground is removed.
- If this does **not** occur, this would indicate a control problem [see sec. 7.20].

## 8.9 Cut-Out Thermostat Testing

### 8.9.1 Testing Overview

The Cut-Out Thermostat is a manually reset device. It is hard wired on the incoming high voltage line, right after the Circuit Breaker or Fuse.

Under normal conditions the contacts in this device are closed, completing the circuit it is in. When an overheating occurs, the Cut-Out Thermostat opens and the circuit is now broken. This will turn off all power to the autoclave. The device will stay open until it is manually reset. This is done by pushing in the red reset button. In some cases, it may be necessary to use a pointed object to depress the button far enough to cause it to catch.

**This thermostat is installed on the autoclave to act as a safety device that detects overheating problems. If it is being activated, do not automatically assume it is defective. Check out the autoclave thoroughly. If no other problem can be found that could be causing this thermostat to be activated, then and only then change this device.**

**Do Not** attempt to adjust this device. This thermostat is set at the factory in a special kiln. If you attempt to field adjust it you will be setting it to the wrong temperature, you may damage the device, the autoclave and the contents of the Chamber as well as voiding the warranty.

### 8.9.2 Testing if the device does not reset

- ◆ Unplug the unit.
- ◆ Disconnect the two wires going to the Cut-Out Thermostat and take an ohm reading across the two terminals. You should be reading a closed circuit. Take into account that a hot autoclave will delay your ability to reset the Cut-Out Thermostat.
- ◆ If the autoclave is not hot and the device cannot be reset, replace the Cut-Out Thermostat.

### 8.9.3 Testing if the device trips too soon

- ◆ Unplug the unit and remove the two wires from the Cut-Out Thermostat.
- ◆ Connect the two wires together.
- ◆ Connect an ohmmeter across the two empty terminals of the Cut-Out Thermostat.
- ◆ Plug the unit in and run several cycles.
- ◆ The ohmmeter should show a closed circuit.
- ◆ If the ohmmeter shows an open circuit and no problem can be found that would cause overheating in the autoclave, replace the Cut-Out Thermostat.



## 8.10 Dip Switch Selection

The dip switches are numbered from left to right on the board and are used to set four different parameters. When a dip switch is in the up position the parameter is on or active. The unit must be off when a dip switch position is changed. Turning the unit on will allow the microprocessor to see the new position.

### 8.10.1 Autoclave Identification number

Switches 1 & 2 are used to set the ID number of the autoclave. The only time the ID number is evident is when it is printed out on the printer tape. By setting the dip switches as shown, the Printer will print the Autoclave # at the end of the tape.

Switch: 1 on & 2 on = number 1

1 on & 2 off = number 2

1 off & 2 on = number 3

1 off & 2 off = number 4

### 8.10.2 Change of Parameters

Switch 3 can be set so that the ability to change the temperature and sterilization parameters from the front Keypad is denied.

Switch: 3 on = unable to change parameters

3 off = able to change parameters

### 8.10.3 Preheat, Standby mode

Switch 4 can set the autoclave so that it will begin to heat the Chamber to a nominal temperature, as soon as the power is turned on. In this mode, it will maintain this temperature for a period of 2 hours unless the autoclave is used, in which case it will reset and start counting 2 hours again. After the 2 hour period has elapsed, this feature will switch itself off until the next time the unit is used. This switch is always on in all **EK**, **EKA**, **EZ10K**, **3850E** and **3870EA** models

Switch: 4 on = mode on

4 off = mode off

### 8.10.4 Printer

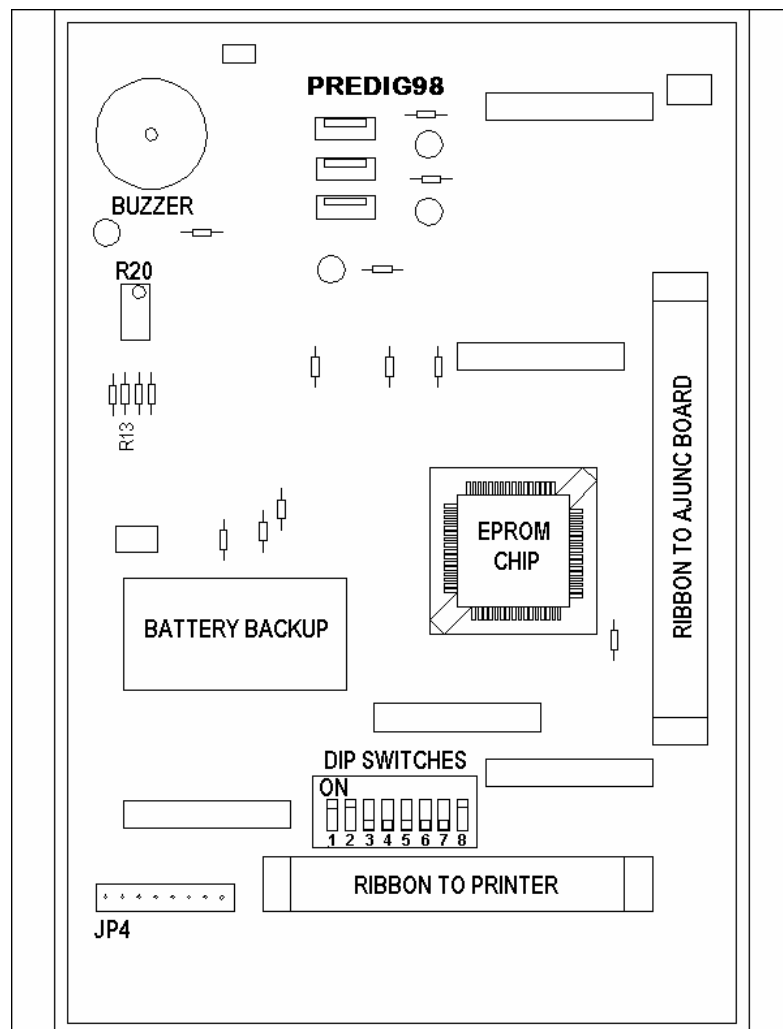
Switch 8 turns the Printer option on or off. If a Printer is not installed, the switch can be in any position.

Switch: 8 on = printer enabled

8 off = printer disabled

**Any other switches on this switch pack have no function and should be left in the off position.**

When installing a new Digital Predg Board, it is important that the dip switches on the new board are made to match the switches on the old board.



Digital Predg Board

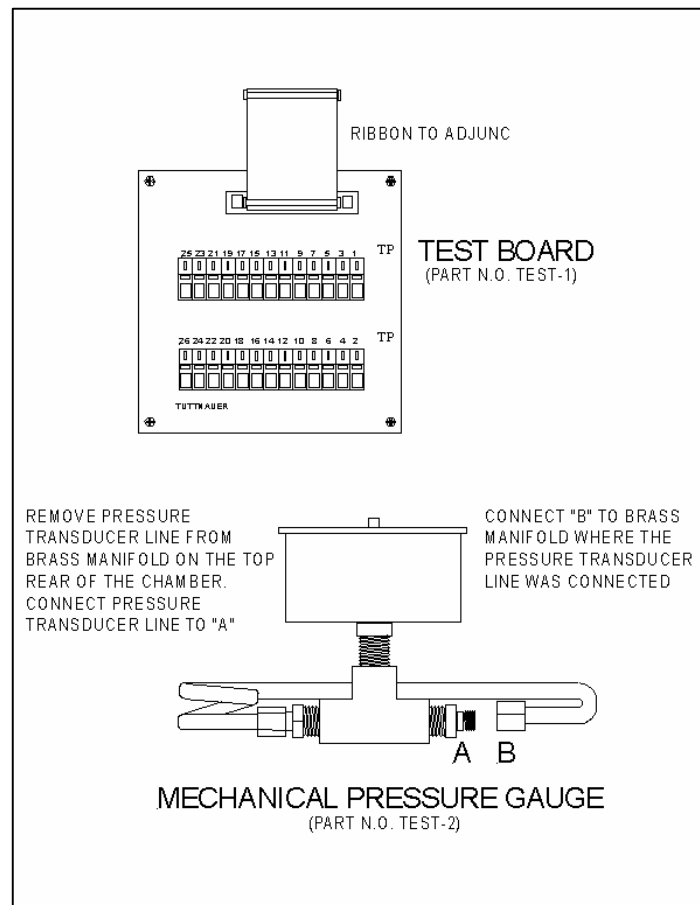
## 8.11 Available Test Equipment

### 8.11.1 Test Point Board

The Test Point Board enables you to check and monitor all the test points on the Ajunc Board without having to search for resistor or chip legs. The test board comes with a ribbon cable and board with the test points clearly marked for easy and convenient access. The part number for the Test Point Board is **Test-1**.

### 8.11.2 Test Pressure Gauge

The Test Pressure Gauge is a good quality pressure gauge with the appropriate piping and connectors to enable it to attach to the Chamber. The Test Pressure Gauge is needed when calibrating or monitoring the pressure inside the Chamber. The part number is **Test-2**.



### 8.11.3 Door Bellows Tap

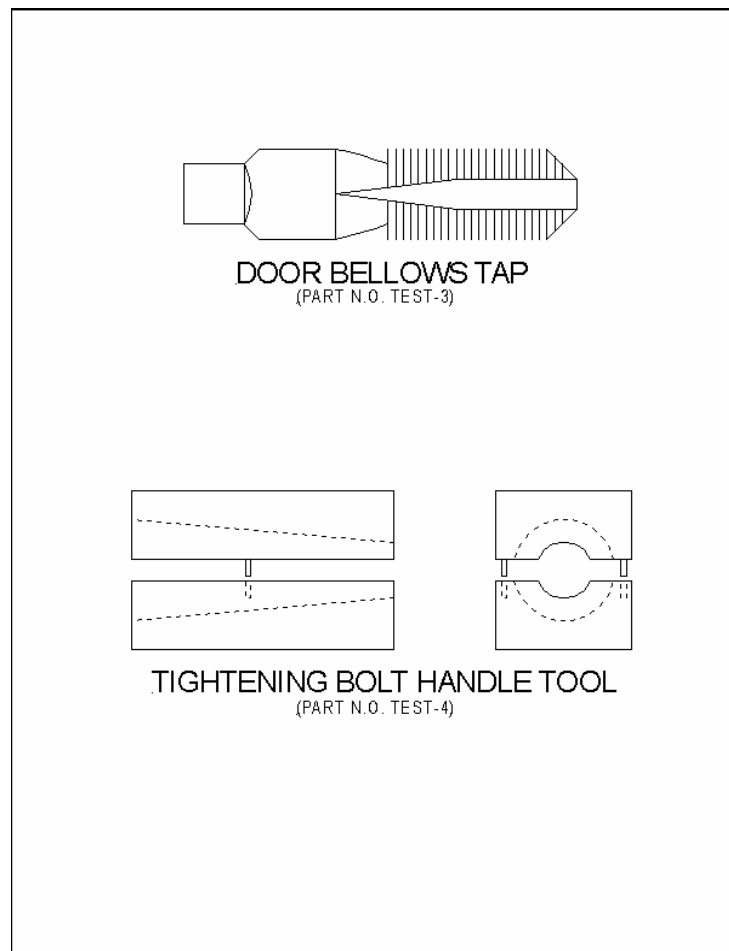
This tap can be used to clean out the threads for the Door Bellows Locking Bolt. These threads may become damaged with age.

The part number is **Test-3**.

### 8.11.4 Door Handle Brass Block

This brass block is molded to fit around the PVC Door Handle. It provides for a secure grip on the handle, without marring or otherwise damaging the handle, while removing or installing into the Closing Device.

The part number is **Test-4**.

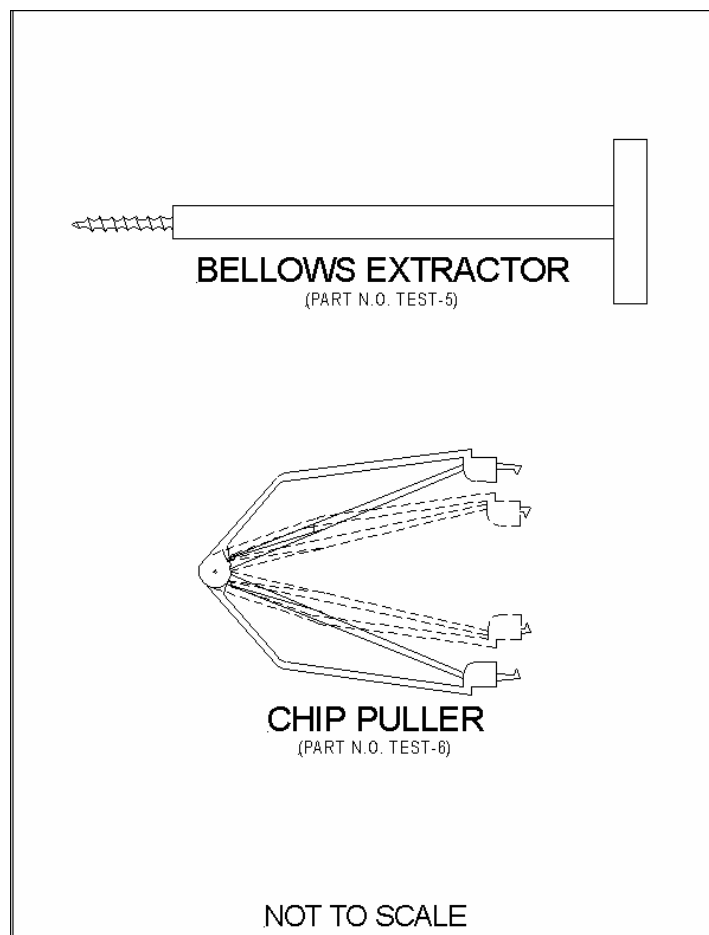


### 8.11.5 Bellows Extraction Tool

The Bellows Extraction Tool is a long handled tool with a threaded end, for gripping the entire Bellow Assembly and removing it from inside the Door. The part number is **Test-5**.

### 8.11.6 Microprocessor Extraction Tool

The Microprocessor Extraction Tool is necessary for removing the Microprocessor chip. It is superior to using a screwdriver or other pointed object. These makeshift extractors can damage the chip or the socket leading to a more expensive repair. The part number is **Test-6**.



### 8.11.7 Printer

The Printer will print out any and all information that is present on the autoclave's Display. This includes temperature and pressure reading as well as all **Error Messages**. The information that comes from the Printer is not only good for record keeping, but it also makes the Printer a valuable diagnostic tool for the technician. In the shop or in the office, the Printer will relieve the technician of having to sit by a machine waiting for an intermittent problem to occur. Once the repair is made, the Printer tape provides a record of a successful repair.

### 8.11.8 Independent thermometer

Independent thermometers are of two types:

1. Lag thermometer – the problem with this type of thermometer is that you can only see the reading at the end of the cycle.
2. Digital Thermometer – this is a better choice because the temperature can be read all during the cycle, making calibration much easier. The best location for the thermocouple is inside the Chamber, as close to the autoclave Temperature Sensor as possible without touching any metal surfaces. Because of the thinness of the wire on this device, it can lay over the rim of the Chamber and when the Door is closed the Door Gasket will still provide a sufficient seal.

Digital Thermometers are available as independent devices or as attachments to a DVM (i.e. Fluke 51).

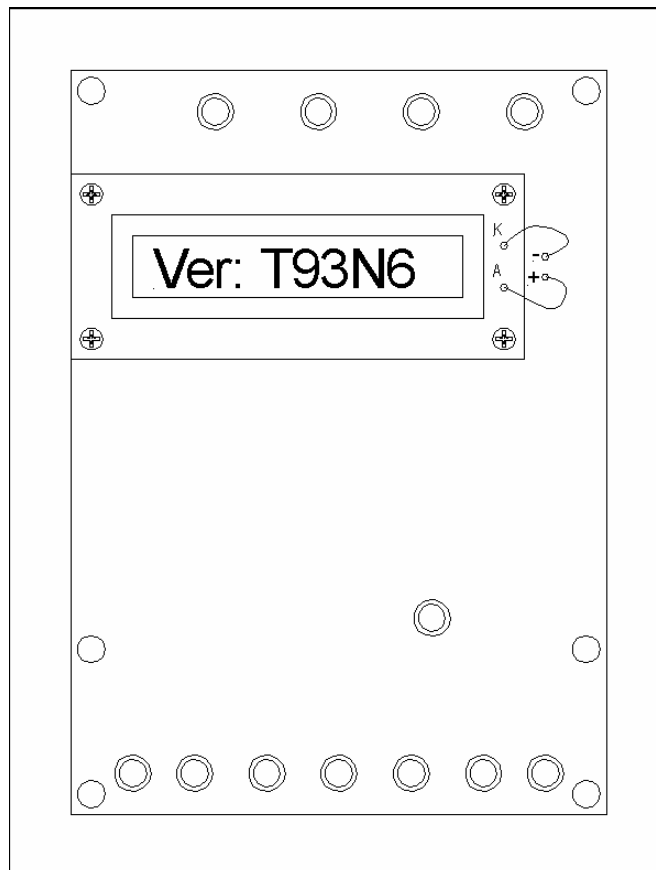
### 8.11.9 PT-100 Simulator

A test box used to simulate the PT-100 temperature sensor. The capability of simulating high and low temperatures makes this a valuable tool for calibrating the temperature in units with an Ajunc 3 board. The part number is **Test-7**.

## 8.12 Finding the Software Version Number

There are two ways to find the **Software version number** for the Microprocessor

1. Cycle the unit off and on.
  - ◆ Using the On/Off Rocker Switch, turn the power off.
  - ◆ Using that same On/Off Switch, turn the power on and observe the Display Screen. The **Software version number** will be the first information displayed.
2. Printer Tape
  - ◆ The first information that is printed before each cycle is the **Software version number**.



## 8.13 In-Out Test

**Available only on units with software version T97N6 and newer**

Before performing any troubleshooting on the autoclave, perform an “IN-OUT test”. In this test all the components of the system can be tested as follows:

1. Turn OFF the autoclave.
2. Press and hold the Up Arrow button and turn the unit back ON. The unit will automatically go into the IN-OUT test mode; the first test will start immediately.
3. Once the first test has started, release the UP Arrow button.
4. To advance to the next test, press the UP Arrow button for one second. Each time the UP Arrow button is pressed the test advances one step. During each test the tested component is shown on the display.
5. To STOP the IN-OUT test, turn the autoclave OFF.

DISPLAYED NOTICE	ITEM ACTIVATED	REMARKS
WATER V + WATER PUMP	Water valve + water pump	Verify that water has entered the chamber
EXH	Exhaust valve	—
HEATERS	Heating elements	Begins heating. <b>**Caution**</b> running this test too long can damage the autoclave
AIR	Air valve	—
WATER P	Water pump	Verify you hear the pump is operating.
DOOR L	Not used	Not used
PUMP	Air pump	Verify you hear the pump is operating.
FLOAT 1	Reservoir float indicates “no water”	Change position of the float switch and verify that the display reflects the change.
FLOAT 0	Reservoir switch indicates “enough water”	
DOOR 0	Door switch indicates “closed door”	Press and release the door switch and verify that the display reflects the change.
DOOR 1	Door switch indicates “open door”	
THERM 0	Temp Safety Thermostat grounded	—
THERM 1	Temp Safety Thermo not grounded	—
PT100	Temperature sensor	Displays ambient temperature.
PRESSURE	Pressure transducer	Open door and verify ambient pressure is displayed.
ELECTRODE X	Water level electrode	X will vary between 001 and 255. 255 indicates “water in the chamber” 001 indicates “no water in chamber”



## 9 Tables and Diagrams

### 9.1 OHM and AMP Readings

#### For the Tuttnauer “E” series machines

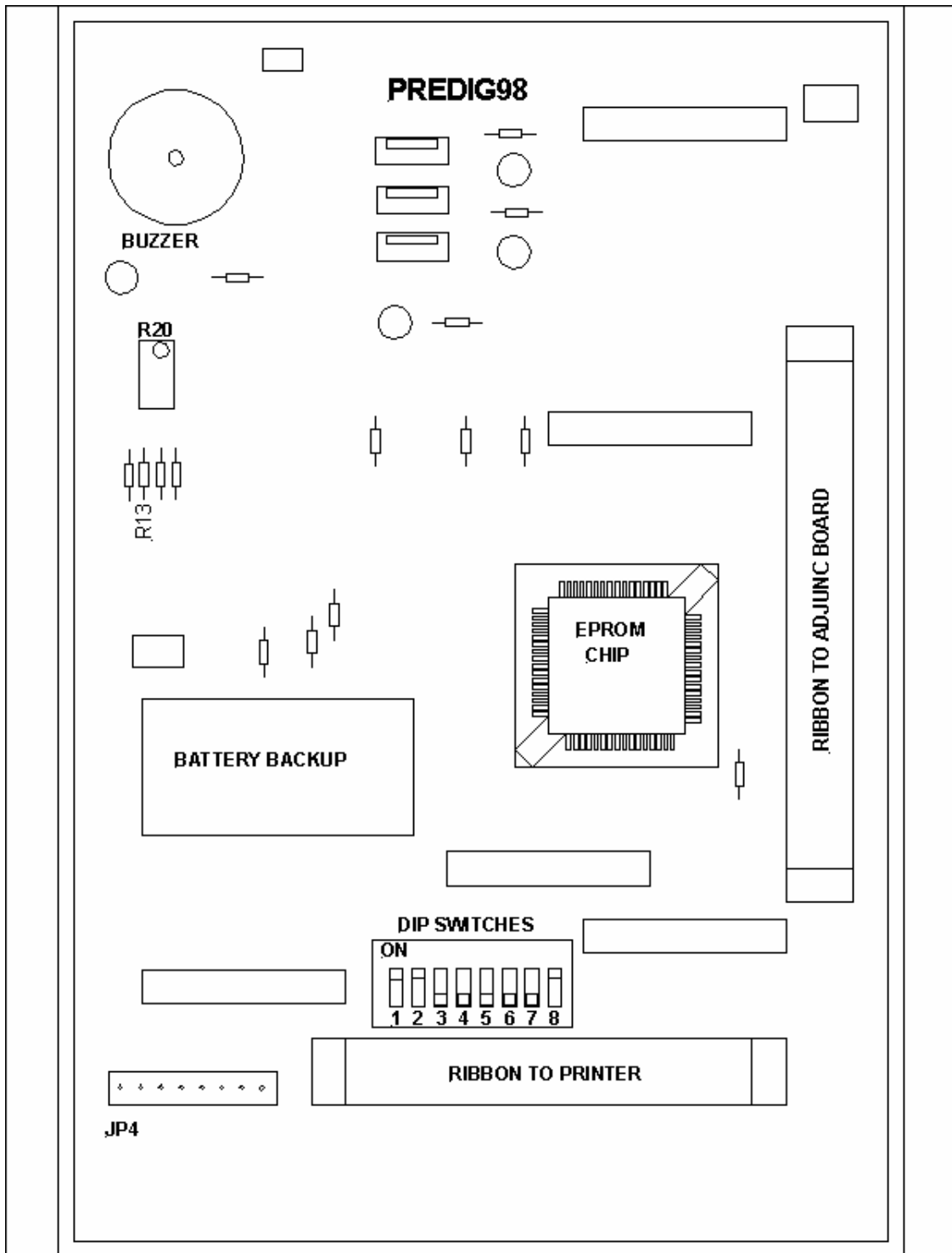
The heating elements on the Automatic Units are wired in a parallel configuration. Therefore, the ohm readings taken on the Automatic Units can be taken across the two terminals of any heating element with the same result.

Model	STE Ohms	STE Amps	Individual Elements Ohms
1730E ----- 120V	13	9.5	35 - 40
1730E ----- 230V	48	4.8	145 - 150
1730EK ----- 120V	9	13	30 - 35
1730EK ----- 230V	38	6	110 -115
2340E, EA ----- 120V	9 - 10	13	35 - 40
2340E, EA ----- 230V	35	6.5	140 - 145
2340EK, EKA ---- 230V	21	11.5	85 - 93
2540E, EA ----- 120V	9 - 10	13	35 - 40
2540E, EA ----- 230V	35	6.5	140 - 145
2540EK, EKA ---- 230V	21	11.5	85 - 93
3140E, EA ----- 230V	28	7.8	84 - 87
3850E, EA ----- 230V	22	10	80 - 96
3870E, EA ----- 230V	19	12	110 - 115
EZ9 ----- 120V	9 - 10	13	35 - 40
EZ10 ----- 120V	9 - 10	13	35 - 40
EZ10k ----- 230V	21	11.5	85 - 93

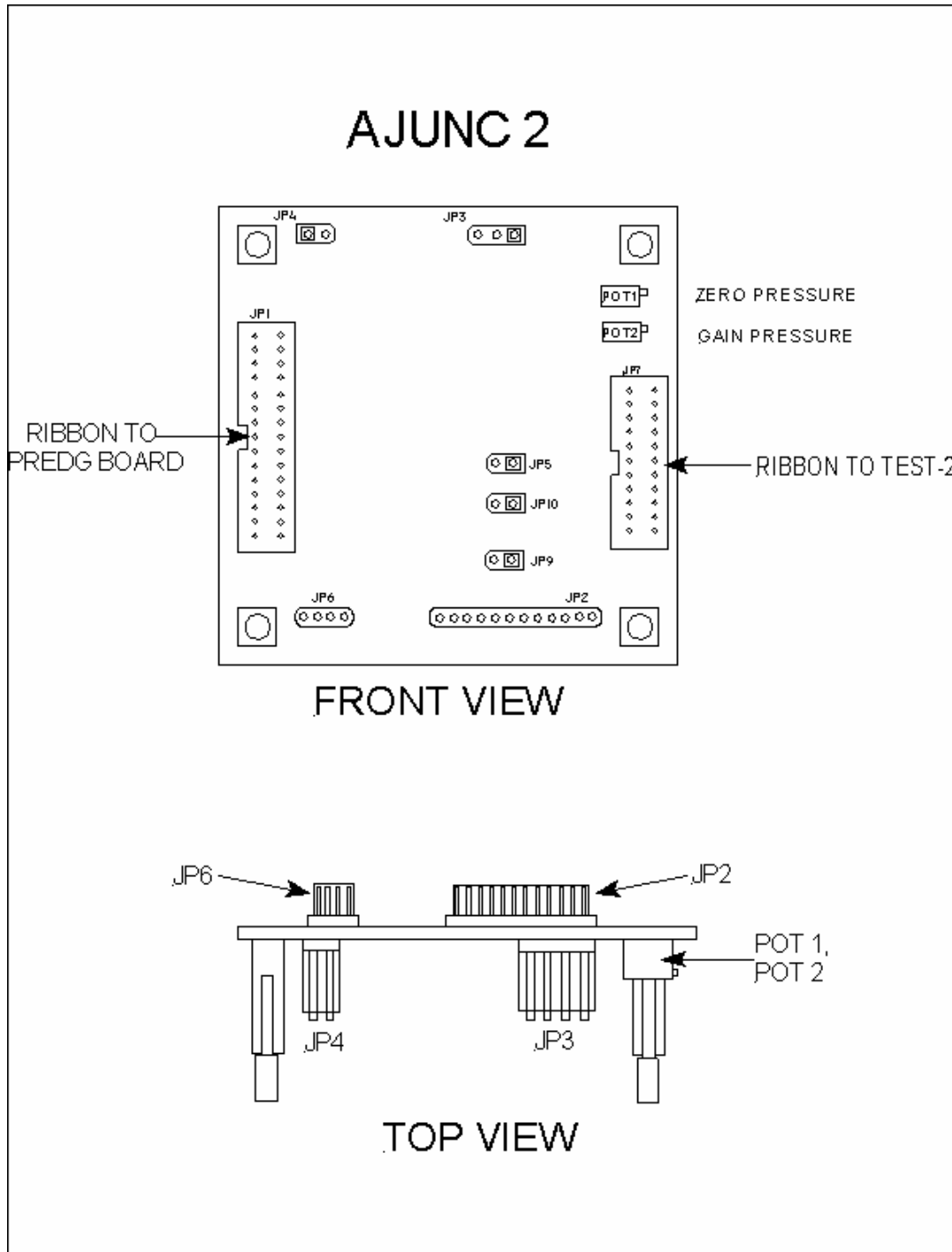
\*\* All readings in this table are + / - 10%

It is **important**, when checking heating elements that you always take a ground reading. **Ideally**, the ground reading taken from the heating element terminal to the chassis should show an open circuit (no reading at all). In the event that there is some leakage to ground, that reading should be **NO LOWER** than 10 Meg Ohms.

The heating elements on these electronic units are always operating at full power. The microprocessor controls the power by switching the heaters on and off at different rates.

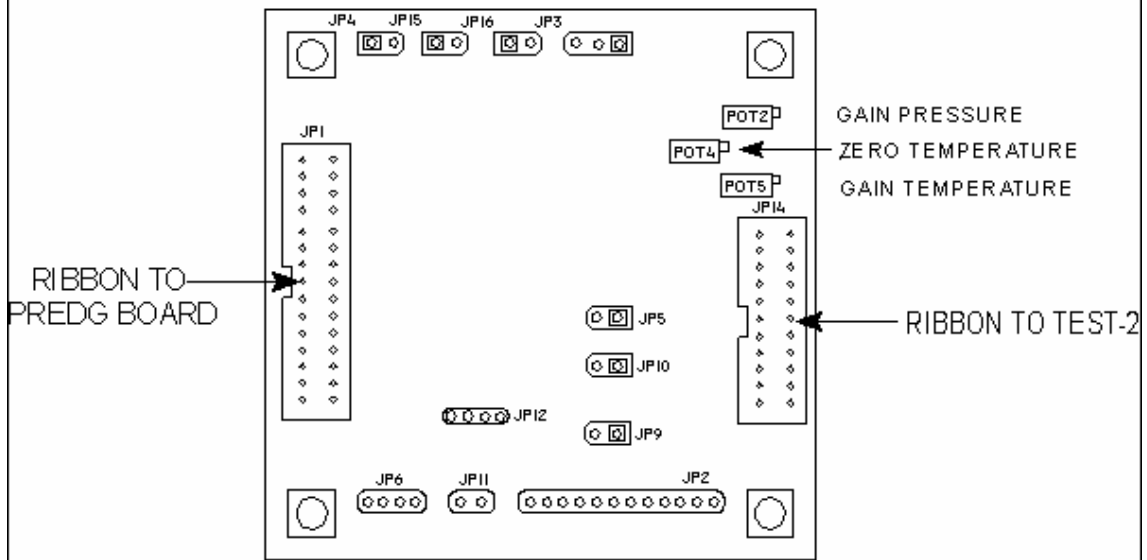


## 9.2 Digital Predg Board

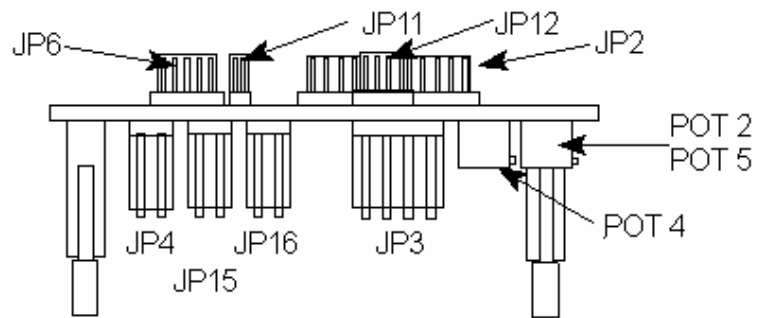


### 9.3 Ajunc 2 Board Basic Layout

# AJUNC 3



FRONT VIEW



TOP VIEW

## 9.4 Ajunc 3 Board Basic Layout

## 9.5 Test Points for Ajunc 2 Board

### 9.5.1 Software Version up to T96DN1

Test Point	Function	Voltage Range DC
TP1	Ground	
TP2	Zero Pressure Reference	
TP3	Zero Pressure Adjustment	0.0 volts
TP4	Analog Pressure Adjustment	0 to 2.5 v = 0 to 2.7 bar
TP5	Analog Temperature	
TP6	Water Fill Electrode	0 to 1 v = no water 3.5 to 5 v = water in chamber
TP7		
TP8	Float Switch	3.5 to 5 v = no water 0 to 1 v = water in reservoir
TP9	Door Switch	3.5 to 5 v = door open 0 to 1 v = door closed
TP10	Water Fill Valve	10.5 to 12 v = closed 0 to 1 v = open
TP11	Exhaust Valve	10.5 to 12 v = closed 0 to 1 v = open
TP12	Heater Control	3.5 to 5 v = no heat, 0 to 1 v = heat
TP13	Fan Control	0 to 1 v = on, 10.5 to 12 v = off
TP14	Air Outlet Valve	0 to 1 v = on, 3.5 to 5 v = off
TP15	VEE	+12 v
TP16		
TP17	VCC	+5 v
TP18	Dry Valve and Dry Pump	0 to 1 v = on, 3.5 to 5 v = off
TP19		
TP20		
TP21		
TP22		
TP23		

## 9.6 Test Points for Ajunc 3 Board

### 9.6.1 Software Versions up to T97DN6

Test Point	Function	Voltage Range DC
TP1	Ground	
TP4	Analog Pressure Adjustment	500 mv
TP6	Water Fill Electrode	0 to 1 v = no water 3.5 to 5 v = water in chamber
TP7	PT100 Output	151.4 $\Omega$ = 2.385 v
TP8	Float Switch	3.5 to 5 v = no water 0 to 1 v = water in reservoir
TP9	Door Switch	3.5 to 5 v = door open 0 to 1 v = door closed
TP10	Water Fill Valve	10.5 to 12 v = closed 0 to 1 v = open
TP11	Exhaust Valve	10.5 to 12 v = closed 0 to 1 v = open
TP12	Heater Control	3.5 to 5 v = no heat, 0 to 1 v = heat
TP13	Fan Control	0 to 1 v = on, 10.5 to 12 v = off
TP14	Air Outlet Valve	0 to 1 v = on, 3.5 to 5 v = off
TP15	VEE	+12 v
TP17	VCC	+5 v
TP20	Dry Valve and Dry Pump	0 to 1 v = on, 3.5 to 5 v = off
TP21		
TP22	Temperature Safety Thermostat	0 to 1 v = closed circuit 3.5 to 5 v = open circuit
TP25	PT100 Zero Temperature Adj	100 $\Omega$ = -5.1 mv
TP26	PT100 Zero Temperature Adj	100 $\Omega$ = -5.1 mv

### 9.6.2 Test Points for Ajunc 3 Board, Software Version T97DN7WP and newer

Test Point	Function	Voltage Range DC
TP1	Ground	
TP4	Analog Pressure Adjustment	500 mv
TP6	Water Fill Electrode	0 to 1 v = no water 3.5 to 5 v = water in chamber
TP7	PT100 Output	151.4 $\Omega$ = 2.385 v
TP8	Float Switch	3.5 to 5 v = no water 0 to 1 v = water in reservoir
TP9	Door Switch	3.5 to 5 v = door open 0 to 1 v = door closed
TP10	Water Fill Valve	10.5 to 12 v = closed 0 to 1 v = open
TP11	Exhaust Valve	10.5 to 12 v = closed 0 to 1 v = open
TP12	Heater Control	3.5 to 5 v = no heat, 0 to 1 v = heat
TP13	Water Pump Control	0 to 1 v = on, 10.5 to 12 v = off
TP14	Air Outlet Valve	0 to 1 v = on, 3.5 to 5 v = off
TP15	VEE	+12 v
TP17	VCC	+5 v
TP20	Dry Valve and Dry Pump	0 to 1 v = on, 3.5 to 5 v = off
TP21		
TP22	Temperature Safety Thermostat	0 to 1 v = closed circuit 3.5 to 5 v = open circuit
TP25	PT100 Zero Temperature Adj	100 $\Omega$ = -5.1 mv
TP26	PT100 Zero Temperature Adj	100 $\Omega$ = -5.1 mv

## 9.7 Maximum Instrument Load

In order for the autoclave to perform sterilization cycles, according to the published specifications, the Maximum Instrument Loading, for solid instruments, must be observed. It is best if this load is spread out among all the available trays. Do not exceed this load for optimum performance.

<b><u>Model</u></b>	<b><u>Max Instrument Load</u></b>
1730	6 lbs (2.7 kg)
2340	8 lbs (3.6 kg)
2540	8 lbs (3.6 kg)
3140 (3545)	11 lbs (5.0 kg)
3850	13 lbs (6.0 kg)
3870	14 lbs (6.4 kg)
EZ9	8 lbs (3.6 kg)
EZ10, EZ10k	8 lbs (3.6 kg)



## 9.8 Maximum Textile Load

In order for the autoclave to perform sterilization cycles, according to the published specifications, the Maximum Textile Loading must be observed. It is best if this load is spread out among all the available trays. Do not exceed this load for optimum performance.

<b><u>Model</u></b>	<b><u>Max Textile Load</u></b>
1730	2 lbs (.9 kg)
2340	2.6 lbs (1.2 kg)
2540	2.6 lbs (1.2 kg)
3140 (3545)	3.6 lbs (1.2 kg)
3850	4.3 lbs (1.4 kg)
3870	4.6 lbs (1.5 kg)
EZ9	2.6 lbs (1.2 kg)
EZ10, EZ10k	2.6 lbs (1.2 kg)

## 9.9 Maximum Liquid Load

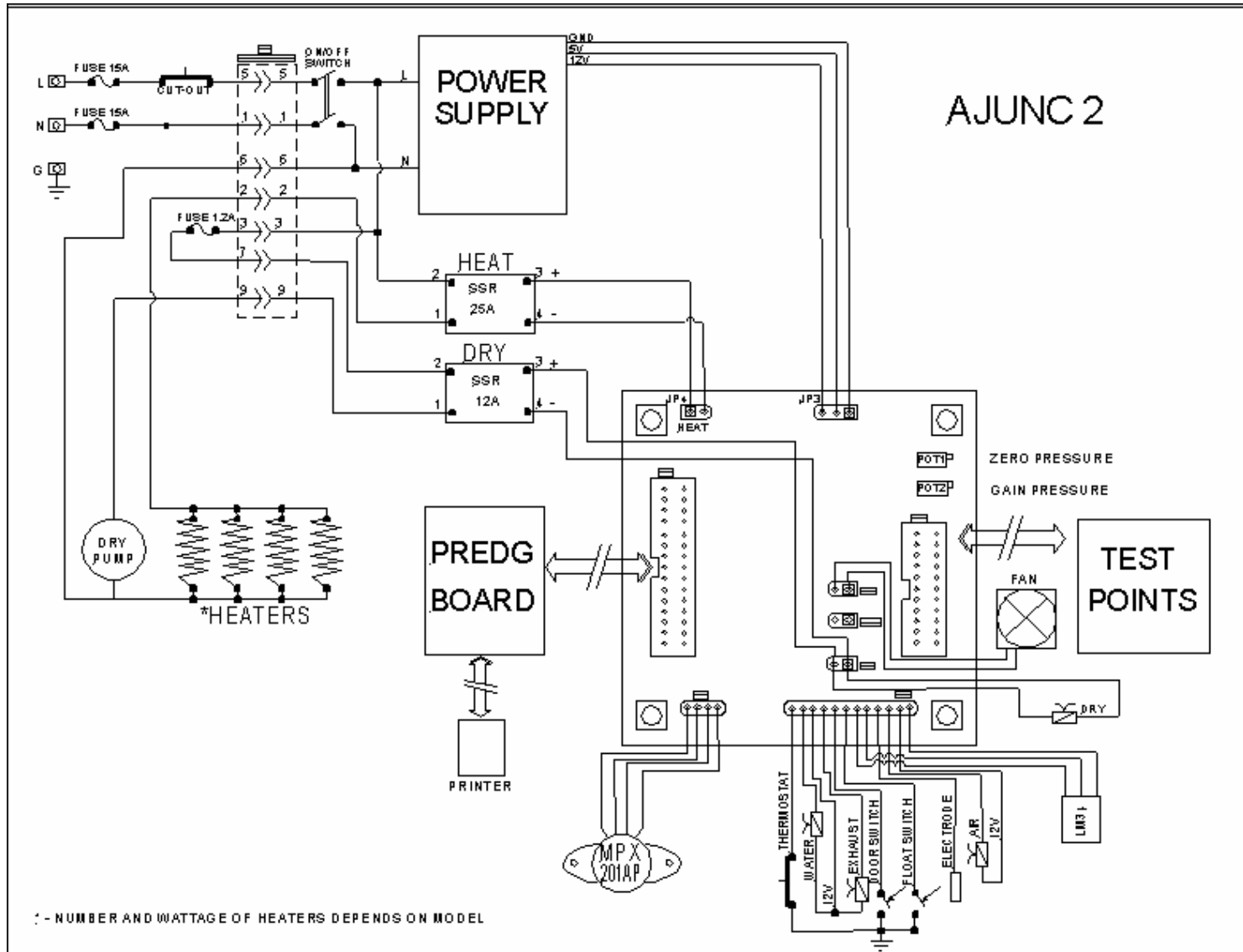
In order for the autoclave to perform liquid sterilization cycles, the Maximum Liquid Loading must be observed. It is best if this load is spread out among all the available trays. Do not exceed this load for optimum performance.

<u>Model</u>	<u>Maximum Liquid Load</u>
1730	16.9 oz (500 ml)
2340	67.6 oz (2.1 qt) (2.0 liter)
2540	84.5 oz (2.6 qt) (2.5 liter)
3140 (3545)	118.4 oz (3.7 qt) (3.5 liter)
3850	223.9 oz (6.9 qt) (6.6 liter)
3870	287.3 oz (8.9 qt) (8.5 liter)
EZ9	67.6 oz (2.1 qt) (2.0 liter)
EZ10, EZ10k	84.5 oz (2.6 qt) (2.5 liter)

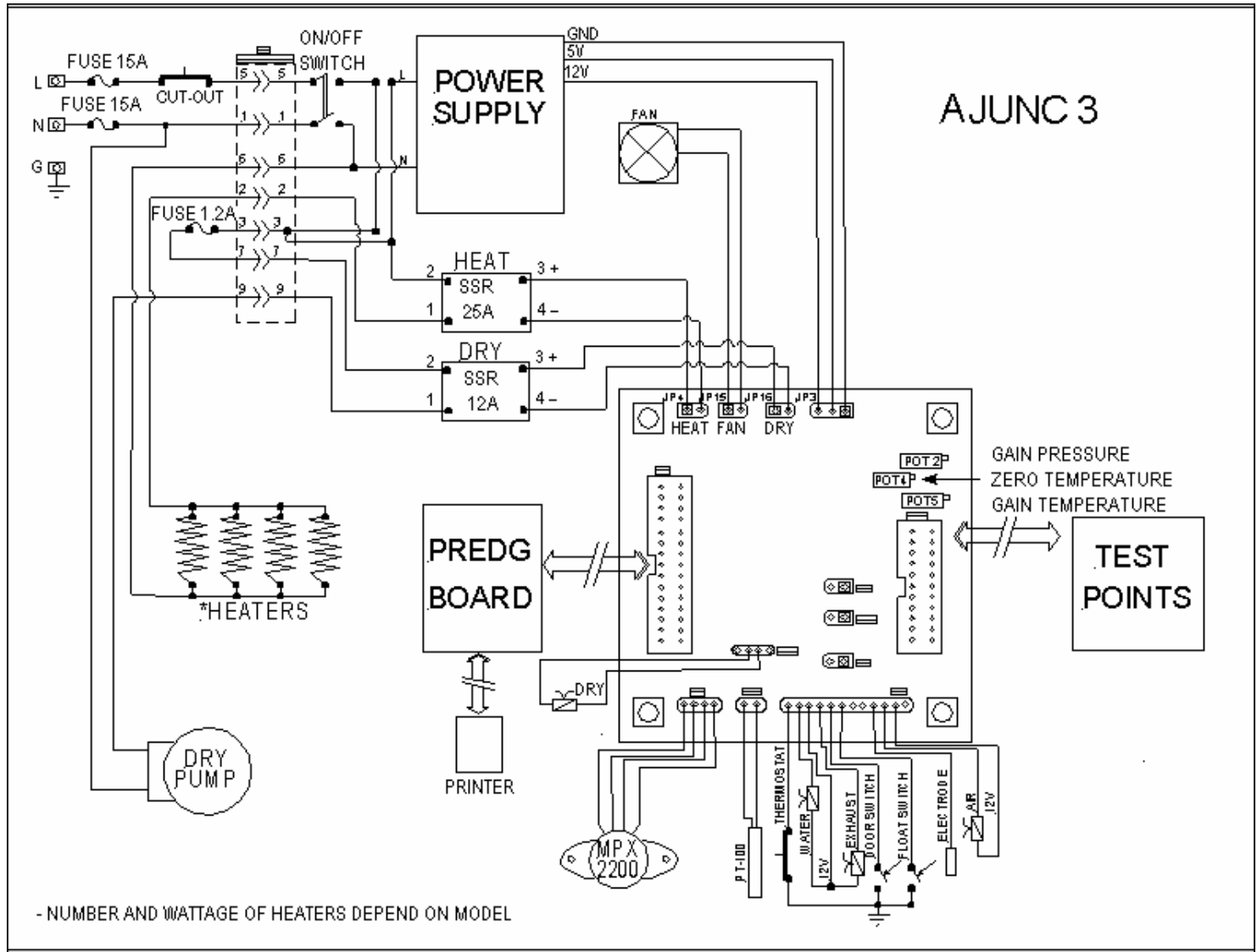
**Note:** Not all units are designed for sterilizing liquids. Consult the Operator's Manual that came with your unit.

## 9.10 Schematics

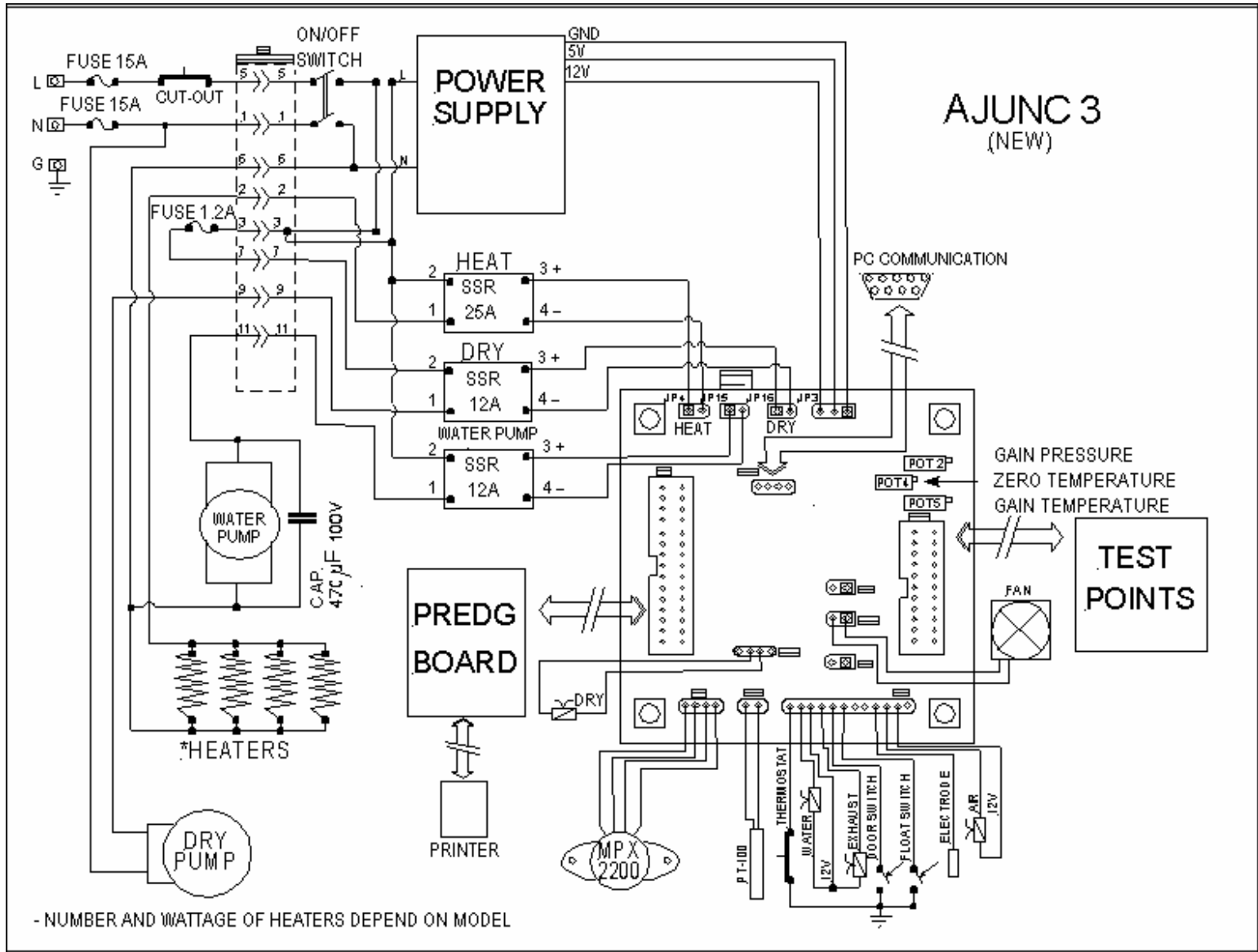
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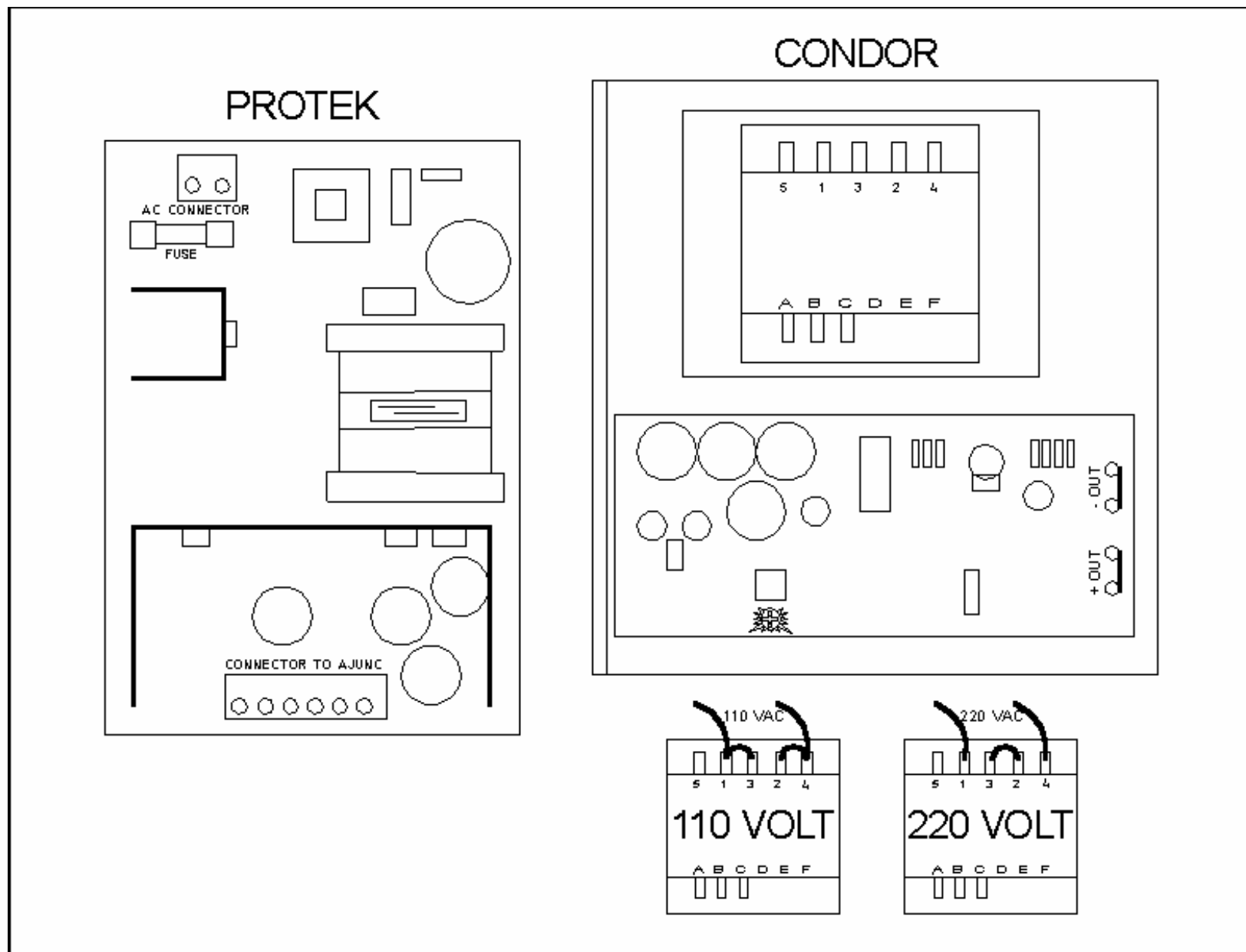
9.10.1 Ajunc 2 Board Schematic



9.10.2 Ajunc 3 Board Schematic – Microprocessor Version Without WP



**9.10.3 Ajunc 3 Board Schematic – Microprocessor Version With WP**



## 9.11 Power Supply

## 9.12 LM34 Cross Reference Table

### Wire Coding for Installation of the LM34 or LM34 Replacement Kit Temperature Sensors

When changing the LM34 temperature sensing device, match the color coding in the table below to the style sensor you received. The pin number in the left hand column refers to the connector that plugs into the back of the Ajunc 2 board. With the connector plugged into the Ajunc 2 board, pin # 1 will be the pin closest to the black ground wire connected to the metal case.

**Step one** is to physically mount the sensor into the manifold at the top rear of the chamber.  
**Step two** is to then insert the wires into the connector at the rear of the Ajunc 2 board.

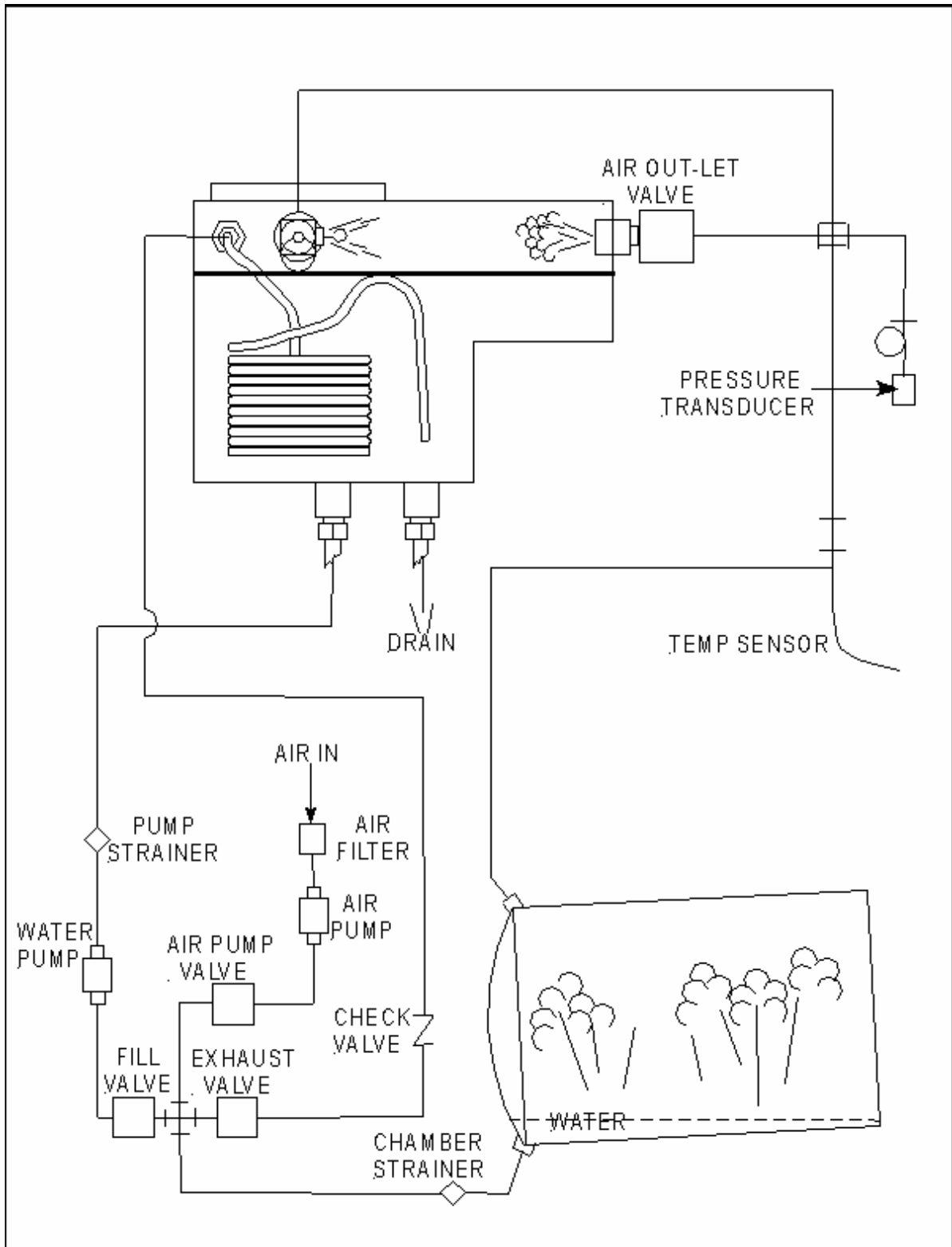
STYLE	# 1 color	# 2 color	# 3 color	# 4 color	# 5 color
OUTPUT Pin # 5 Active Temp	WHITE	GREEN	GRAY	GREEN	BLACK
INPUT Pin # 6 5 volts DC	RED	ORANGE	BROWN	RED	BLUE
GROUND Pin # 1	BLACK	BLACK	BLACK	BLACK	BARE



**LM34**



**LM34 REPLACEMENT**

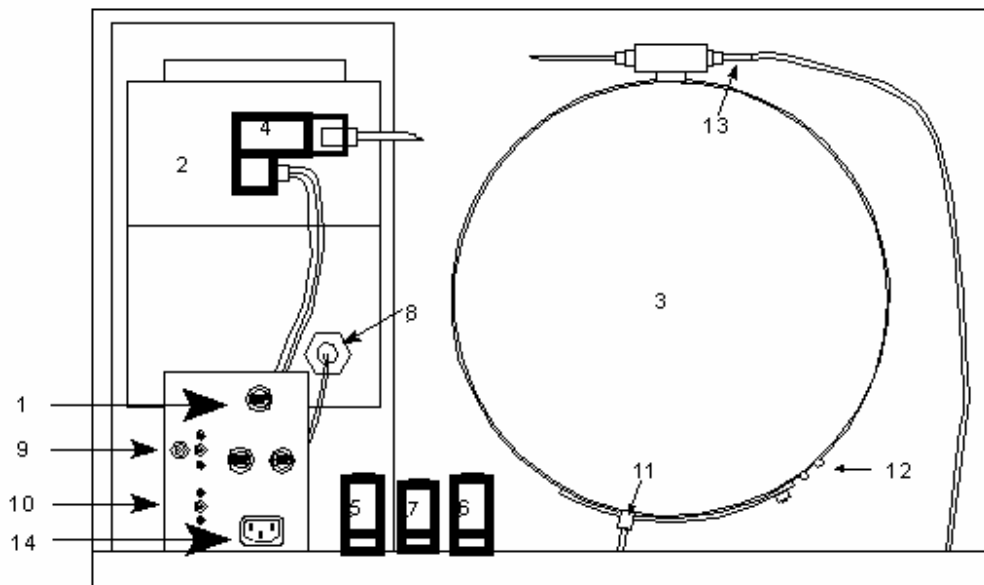


**9.13 Solenoid Valve Schematic**



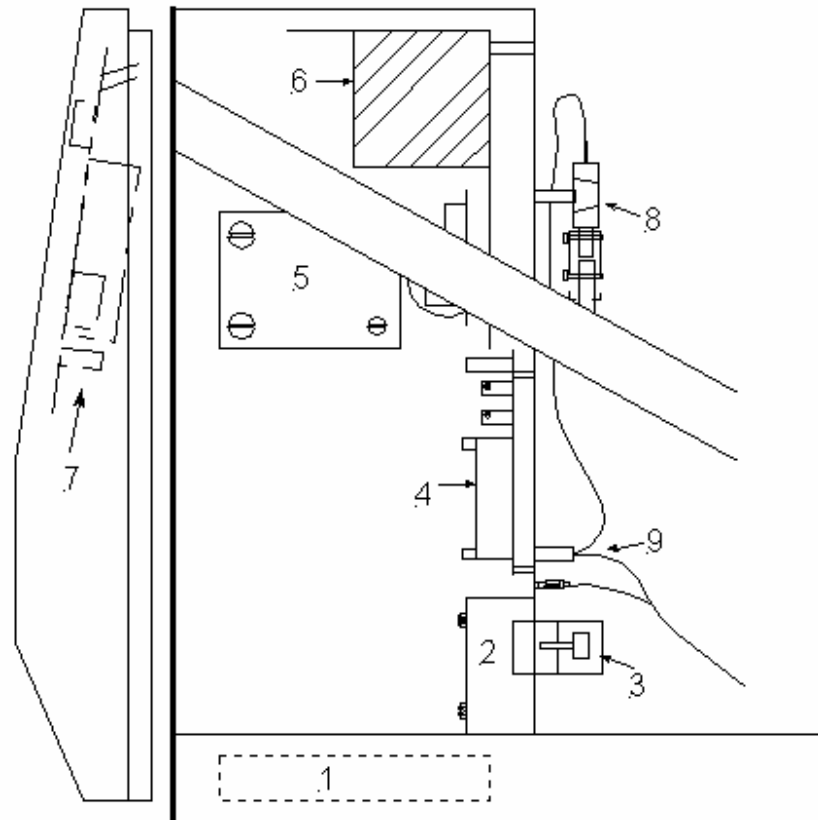
## REAR VIEW COMPONENTS

- 1 - optional fuse
- 2 - water reservoir
- 3 - chamber
- 4 - air outlet valve (3mm plunger)
- 5 - fill valve (6mm plunger)
- 6 - exhaust valve (3mm plunger)
- 7 - dry valve (3mm plunger)
- 8 - water level switch (float switch)
- 9 - cut-out thermostat (manual reset)
- 10 - safety thermostat (automatic reset)
- 11 - electrode for water fill (water electrode)
- 12 - upper channel for cut-out thermostat  
lower channel for safety thermostat
- 13 - temperature sensor (LM34, LM34 replacement kit  
or PT-100)
- 14 - socket for power cord



### 9.14 Autoclave Rear View

- 1 - AXIAL FAN
- 2 - SOLID STATE RELAY
- 3 - AC CONNECTOR
- 4 - AJUNC TYPE BOARD
- 5 - SOLID STATE RELAY (OPTIONAL , EAVEKA)
- 6 - POWER SUPPLY
- 7 - DIGITAL PREDG BOARD (BEHIND KEYPAD)
- 8 - PRESSURE TRANSDUCER
- 9 - AJUNC CONNECTORS



ELECTRICAL BOX (RIGHT SIDE VIEW)

### 9.15 Autoclave Electronic Box Components

## 9.16 Chamber Brite Cleaning Instructions

### **INSTRUCTIONS FOR CLEANING YOUR TABLETOP AUTOCLAVE WITH CHAMBER BRITE**

CHAMBER BRITE is a cleaning and descaling agent designed specifically for the cleaning and removal of water deposits, oxides and other sediments that are found in steam sterilizers. The material is a combination of acidic salts and additional cleaning materials.

#### **CLEANING PROCEDURE**

- 1. Important – all steps in this procedure must be completed without interruption.**
- 2. WHEN AUTOCLAVE CHAMBER IS COLD**, remove instruments and trays from the autoclave.
3. Open the door and spread the contents of a packet in a straight even line along the bottom of the chamber, from back to front.
4. Select and start program No. 1 (without dry). When the cycle is finished it will automatically exhaust.
5. At the end of the exhaust cycle, drain the water from the reservoir.
6. Fill the water reservoir with distilled water.
7. Repeat a sterilization cycle without Chamber Brite powder, to remove any excessive dirt in the pipes. Select and start program No. 1 (without dry). When the cycle is finished it will automatically exhaust.
8. At the end of the exhaust cycle, drain the water from the reservoir.
9. Turn the autoclave off and allow chamber to cool.
10. Remove the tray holder; wipe the interior of the chamber with a damp cloth.
11. Fill the reservoir with distilled water or mineral free water only.
12. Press the manual water fill button and allow a small amount of water (2-4 ounces) to fill chamber. Remove water from chamber.
13. The instrument is ready to use.

**IMPORTANT: DO NOT sterilize instruments during the cleaning process!!!**

**CAUTION:** Keep out of reach of children. Contains mildly acidic ingredients. Avoid contact with the skin, eyes or clothing. Wash hands well after touching the powder, in the case of eye contact flush with continuous running water for at least 15 minutes. If irritation persists, get medical attention. If accidentally swallowed, do not induce vomiting, drink large amounts of water and obtain medical attention. MSDS available upon request.

For models 1730, 2340, 2540 use one packet of CHAMBER BRITE™.

For models 3140 (3545), 3850, 3870 use two packets of CHAMBER BRITE™.

Clean every 20 cycles or as needed.

All cycles referenced are from a cold start.

## 10 Replacement

### 10.1 Heating Element Replacement

**Unplug the unit before proceeding**

#### 10.1.1 Proper Heating Element Selection

Use the proper element - there is a wide variety of heating elements available for the Tuttnauer sterilizers and some do look similar. *They all contain a stamp that tells exactly which model machine they belong on.* The stamp also describes the voltage that each element is suited for. Our standard machines **E**, **EA** and **EZ** can come with either 110 volt or 230 volt elements. We also have Kwiklave machines **EK**, **EKA** and **EZ10k**. (The 2340 and 2540 EK and EKA models are 230 volts. The 1730EK model is 110 volts. The EZ10k model is 230 volts).

**Be sure to get the proper element for your machine.**

#### 10.1.2 Removing the mounting bolts

When removing the elements, loosen the bolts that hold the element around the Chamber. Swivel the elements to gain access to the wires [see sec. 10.1.3]. Remove the wires. Continue removing the bolts, rotating the elements until they come off the Chamber.

#### 10.1.3 Removing the Heating Element Wires

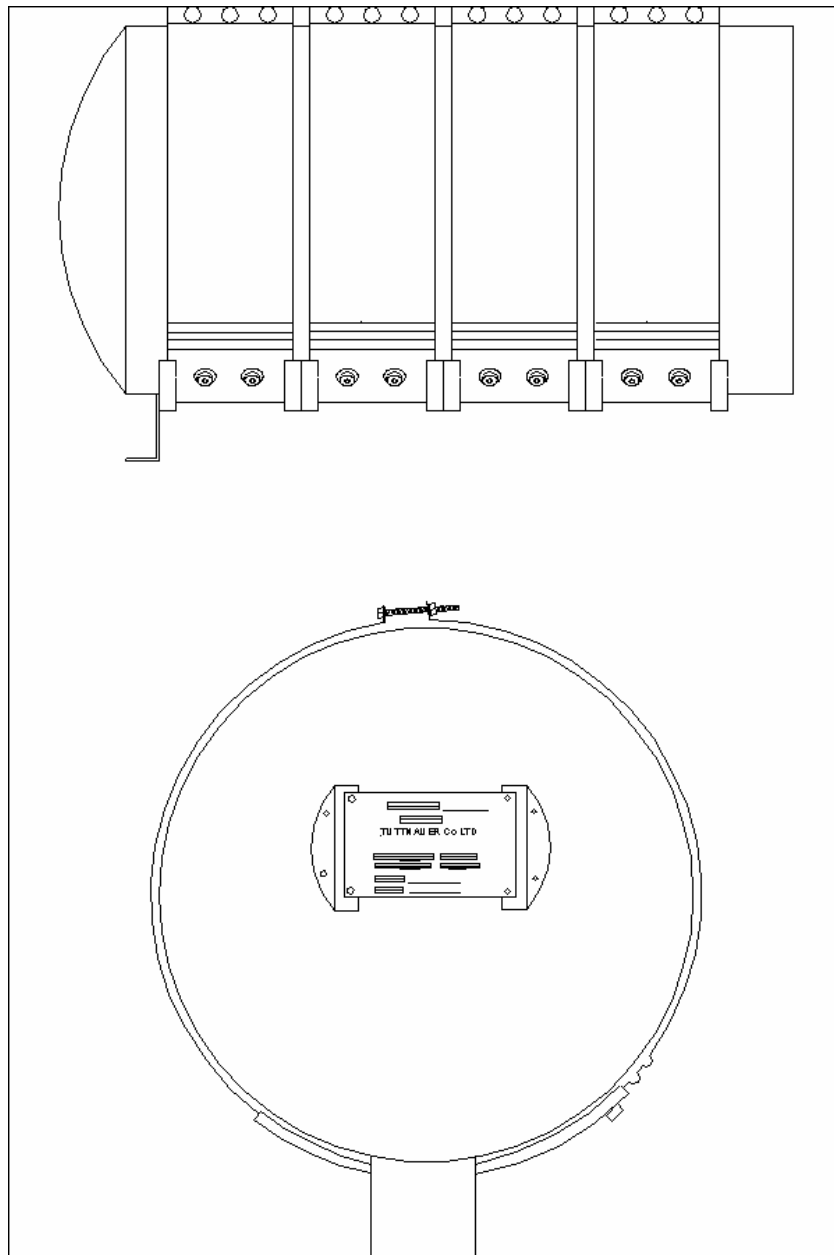
When removing or installing the heating element wires, **always** hold the terminal with a pair of pliers while turning the screw. If the terminal itself is allowed to twist and turn, there is danger that the internal connection to the element will be broken and the heating element will become useless.

#### 10.1.4 Removing the Heating Elements

With the wires and the bolts removed, [see sec. 10.1.2 and sec. 10.1.3] rotate the elements until the tabs of the elements pass below the reservoir and tubing. At this point, the elements will easily come away from the Chamber.

### 10.1.5 Mounting new Heating Elements

When installing the elements, the rear most element goes on first and is positioned as far back on the Chamber as possible. The remaining elements are installed butted up to the element before it. There should be no spaces between the heat pads of the elements. It is normal for new elements to smoke and smell slightly the first and second time the autoclave is run.



### 10.1.6 Attaching the Heating Element Wires

When removing or installing the heating element wires, **always** hold the terminal with a pair of pliers while turning the screw. If the terminal itself is allowed to twist and turn, there is danger that the internal connection to the element will be broken and the heating element will become useless.

### 10.1.7 Aligning the Heating Elements

**The elements need to be centered properly with the bottom of the chamber.** Starting with the rear most element, tighten the element loosely. Visually center the heating pad with the belly of the Chamber.

The bolts at the top of the element and the weld seam at the top of the Chamber cannot be used for proper centering due to eccentricities in the manufacture of the elements and the Chamber. Once the rear element is centered, tighten it down and then align the edge of the next heating pad to the first, tighten it down and continue to move forward.

If the elements are skewed up on the side of the Chamber, this will cause the elements to work harder trying to drive the heat down to the bottom of the Chamber where the water is. The elements **will always** try to drive the heat to the bottom of the Chamber where the water is. Skewing the elements up on the side of the Chamber will result in the elements constantly overheating and shortening their life span.

### 10.1.8 Tightening the Heating Elements

The key to properly tightening the heating elements is to watch the tabs at the top of the elements. As long as they remain straight, tightening the bolts will result in tightening the element. When only the tops of the tabs are moving toward each other, you are not tightening the elements anymore; you are only deforming the tabs.

When tightening the elements, it is important to make them tight. If the elements are not tightened properly, an air gap will develop between the heating pad and the Chamber. This gap will cause the element to work harder to drive the heat across the air gap into the Chamber. This will result in the element constantly overheating and shortening its life span.

## 10.2 Temperature Safety Thermostat Replacement

Installation and replacement procedures are identical for both the Temperature Safety Thermostat and the Cut-Out Thermostat.

**DO NOT ATTEMPT TO ADJUST THESE DEVICES.**

\*\*\*\* These two devices are calibrated at the factory and do not require calibration. \*\*\*\*

**Tampering with the adjustment on these devices will totally defeat the safety feature of this device.**

The only recommendation is that a defective device be replaced with a properly calibrated factory replacement.

For more information regarding troubleshooting these devices see sec. 7.7.

### 10.2.1 Remove wires from the thermostat

- ◆ Unplug the unit.
- ◆ Remove the wires from the terminals.
- ◆ Note which wires are connected to which terminals. Some devices will have a ground terminal and a green ground wire attached.

### 10.2.2 Remove the thermostat body

- ◆ Remove the two screws holding the device to the mounting bracket or unscrew the locknut, whichever method is being used to secure the device.

### 10.2.3 Remove the probe

- ◆ Loosen the bolts on the rear most Heating Element or whichever element the probe is held in place by.
- ◆ Remove the probe.

#### 10.2.4 Mount the new thermostat body

- ◆ Carefully uncoil the tubing connecting the probe to the contact body. The probes and the tubing leading to the body of the thermostat are filled with liquid. It is important that while working with these sensors, the tubing not be kinked. If the tubing is kinked or the probe punctured, the device will not work and should be replaced.
- ◆ Mount the new thermostat body using the screws or locknut that was removed in the previous step.
- ◆ Carefully route the probe and tubing over to the rear Heating Element.

#### 10.2.5 Install the new probe

- ◆ The new probe should be installed in the proper channel on the rear most Heating Element, regardless of what element the probe was under originally.
  - The Temperature Safety Thermostat is in the lower channel.
  - The Cut-Out Thermostat is in the upper channel.This is easy enough to remember because the body of the Cut-Out Thermostat is mounted on the top portion of the mounting bracket. The body of the Temperature Safety Thermostat is mounted on the bottom portion of the mounting bracket.

#### **Improper mounting of the probes will result in a malfunctioning of the autoclave.**

- ◆ If the replacement thermostat has a long probe, it is only necessary to secure the rear portion of the probe under the rear most element.
- ◆ Retighten the Heating Element, making sure that the probe is held securely between the element and the Chamber. It is important that the probes be snug in the channels of the Heating Elements. If they are loose, they will **not** make good contact with the Chamber and they will **not** properly sense the temperature. Flattening the channel on the Heating Element slightly is an acceptable way of snugging the probe.

#### 10.2.6 Reconnect the wires

- ◆ Reconnect the wires to the same terminals that they were removed from.
- ◆ Be careful not to connect a high voltage wire to the ground terminal.
- ◆ If the replacement device does not have a separate ground terminal, the ground wire need not be connected. Screwing the device to the mounting bracket will supply sufficient grounding.



## 10.3 Temperature Sensor Replacement

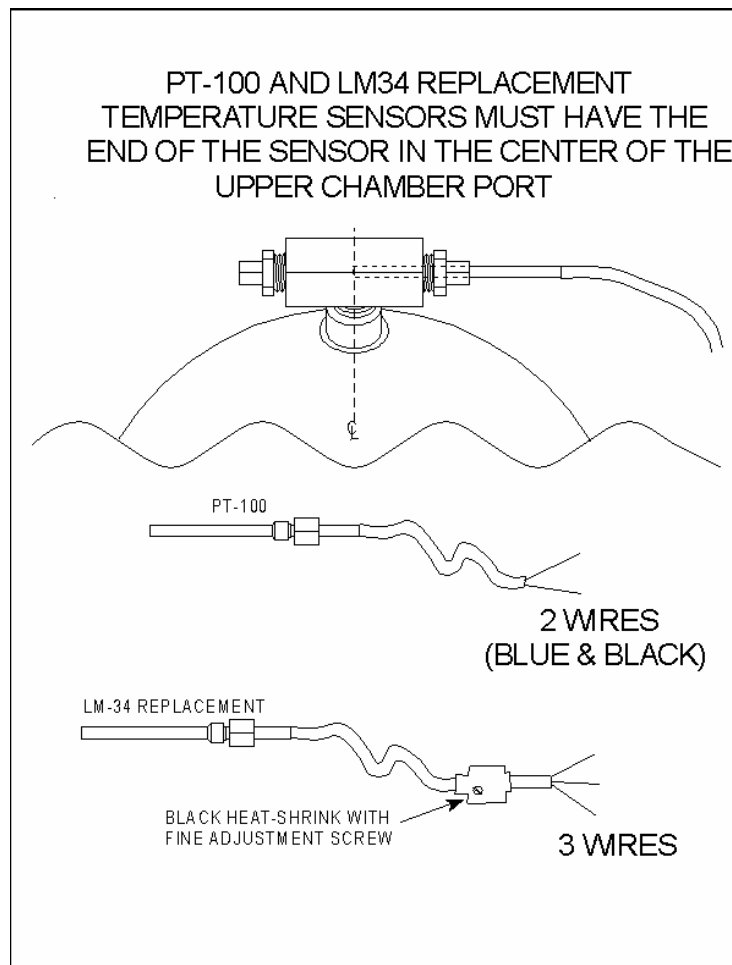
### 10.3.1 LM34 Temperature Sensor

- ◆ Unplug the unit.
- ◆ Remove the three Temperature Sensor wires from the JP2 connector. The JP2 connector is the long 12-pin connector that plugs into the back of the Ajunc 2 Board. Looking at the connector as it is plugged into the Ajunc 2 Board, the number one pin is the first on the left. The wires that need to be removed are 1, 5 and 6.
- ◆ Unplug the connector and through the window on the plastic connector, press down on the metal catch with a pointed tool. This will release the pin for that wire.
- ◆ Once the wires are removed, unscrew the Temperature Sensor from the manifold on the back of the Chamber.
- ◆ Take the replacement LM34 Temperature Sensor and screw it into the manifold at the rear of the Chamber. Use a hydraulic sealant on the threads to protect against leaking.
- ◆ If installing an LM34 Replacement part, take the LM34 Replacement Temperature Sensor and insert it into the manifold at the rear of the Chamber. Position the Temperature Sensor in the manifold so that the tip of the sensor is up to but not passed the center of the upper port on the Chamber. Tighten down the compression connector to secure the sensor in place (see drawing below).
- ◆ Route the Temperature Sensor cable to the back of the Ajunc 2 Board making sure to keep it well away from the Chamber.
- ◆ Reinstall the wires into the JP2 connector as per the LM34 Cross Reference Table in sec. 9.12. Locate the catch on the pin; it should be in the up position when inserted into the connector. The window in the connector should likewise be in the up position to receive the pin. Push the pin in until you hear a click. The pin should now be locked in position.
- ◆ Plug the JP2 connector into the Ajunc 2 Board.
- ◆ Proceed with the calibration procedure as outlined in sec. 8.4.

### 10.3.2 PT100 Temperature Sensor

- ◆ Unplug the unit.
- ◆ Remove the two Temperature Sensor wires from the JP11 connector. The JP11 connector is the 2-pin connector that plugs into the back of the Ajunc 3 Board.
- ◆ Unplug the connector and through the window on the plastic connector, press down on the metal catch with a pointed tool. This will release the pin for that wire.

- ◆ Once the wires are removed, unscrew the compression fitting and remove the Temperature Sensor from the manifold on the back of the Chamber.
- ◆ Take the replacement Temperature Sensor and insert it into the manifold at the rear of the Chamber. Position the Temperature Sensor in the manifold so that the tip of the sensor is up to but not passed the upper port on the Chamber. Tighten down the compression connector to secure the sensor in place (see drawing below).
- ◆ Route the Temperature Sensor cable to the back of the Ajunc 3 Board making sure to keep it well away from the Chamber.
- ◆ Reinstall the wires into the JP11 connector, for this device either wire can go into either spot on the connector. Locate the catch on the pin; it should be in the up position when inserted into the connector. The window in the connector should likewise be in the up position to receive the pin. Push the pin in until you hear a click. The pin should now be locked in position.
- ◆ Plug the JP11 connector into the Ajunc 3 Board.



## 10.4 Pressure Sensor Replacement

There are two Pressure Sensors in use on the Electronic units.

— The MPX 201 is used with the Ajunc 2 Board.

— The MPX 2200 is used with the Ajunc 3 Board.

Both Pressure Sensors are replaced the same way.

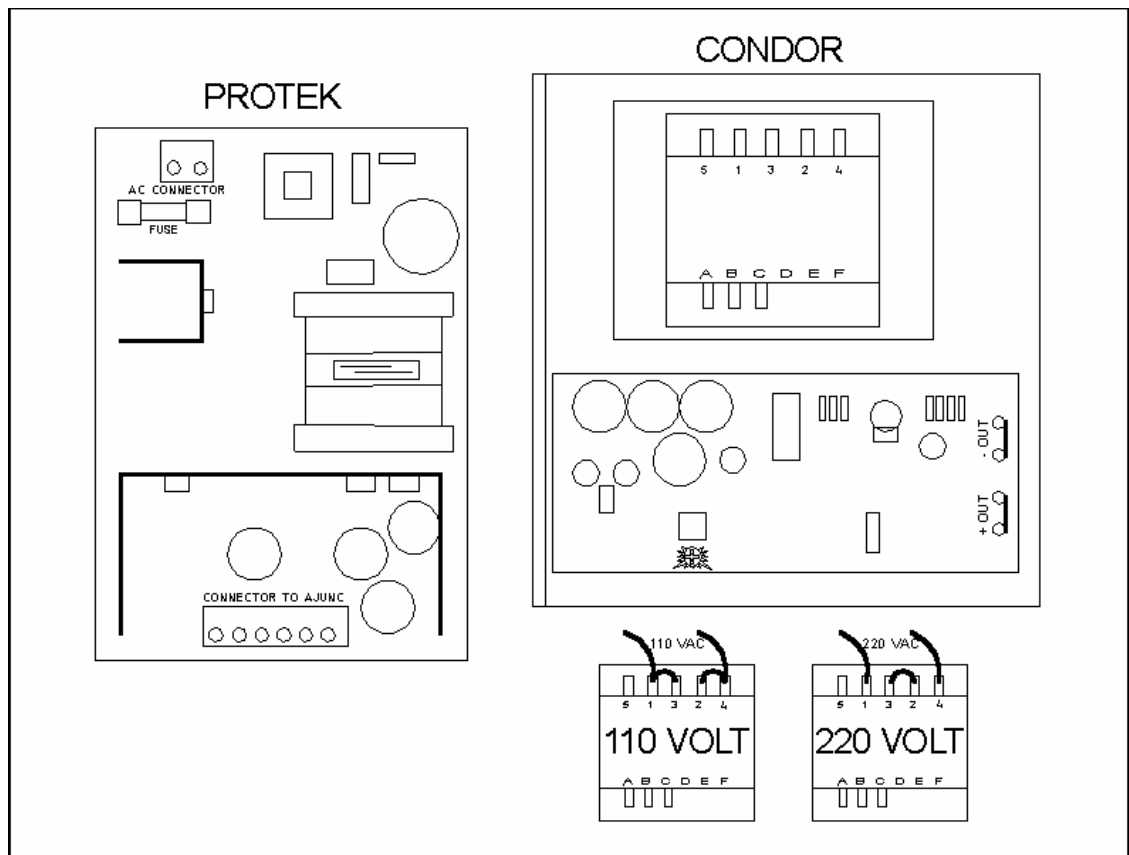
- ◆ Unplug the unit.
- ◆ Unplug the JP6 connector. JP6 is a 4-pin connector on the back of both the Ajunc 2 Board and Ajunc 3 Board.
- ◆ Cut the cable tie holding the silicone tube to the base of the sensor.
- ◆ Remove the sensor from its mounting.
- ◆ Securely mount the new sensor.
- ◆ Reconnect the silicone tube and secure with a cable tie.
- ◆ Plug in the JP6 connector.
- ◆ Proceed with the calibration procedure as outlined in sec. 8.5.

## 10.5 Power Supply Replacement

**There are two types of power supplies used in the Tuttnauer Autoclaves**

The **Condor** Power Supply was used on machines until 1996. This supply is easily distinguished by its large heavy transformer. The transformer has input taps that need to be set to accommodate the input voltage, either 110 or 230 volts.

The **Protek** Power Supply has been used since 1996. Its most distinguishing feature is that it **does not** have a large heavy transformer. There are no input taps to set; this supply is designed to operate on either 110 or 230 volt without any adjustment. In addition, this Power Supply carries its own fuse protection.



### 10.5.1 Replacement of a Condor Power Supply

- ◆ Unplug the autoclave from the wall outlet.
- ◆ Remove the Outer Cabinet.
- ◆ Disconnect the JP3 connector from the Ajunc 2 Board.
- ◆ Clip the cable tie holding the input wires.
- ◆ Remove the nuts holding the Power Supply in the Electronic Box.
- ◆ Remove the Power Supply, being careful not to lose any of the nuts, screws or plastic standoffs.
- ◆ Disconnect the input power. The input wires will need to be unsoldered from the top of the transformer.
- ◆ Solder the input wires to the top of the transformer on the new Power Supply.
- ◆ For a 120-volt unit, there needs to be a jumper wire soldered across terminals 1–3 and 2–4. The input wires are soldered to terminals 1 and 4.
- ◆ For a 230-volt unit, there needs to be a jumper wire soldered across terminals 2–3. The input wires are soldered to terminals 1 and 4.
- ◆ Install the new Power Supply onto the screws and standoffs protruding from the back wall of the Electronic Box and secure in place with the nuts.
- ◆ Connect the JP3 connector to the Ajunc 2 Board.
- ◆ Secure the input wires with a new cable tie.

### 10.5.2 Replacement of a Protek Power Supply

- ◆ Unplug the autoclave from the wall outlet.
- ◆ Remove the Outer Cabinet.
- ◆ Disconnect the JP3 connector from the Ajunc Board.
- ◆ Disconnect the input power connector from the Power Supply.
- ◆ The **Protek** Power Supply is held in place with plastic clips.
  - Squeeze the tips of the clips with a pair of needle nose pliers to release them.
  - Once all the clips have been released, the Power Supply can be removed.
- ◆ Take the new Power Supply and position it over the plastic clips. Press down and the clips will automatically lock.
- ◆ Reconnect the JP3 connector to the Ajunc Board.
- ◆ Reconnect the input power connector to the Power Supply.

### **10.5.3 Replacing a Condor supply with a Protek**

- ◆ Unplug the autoclave from the wall outlet.
- ◆ Remove the Outer Cabinet.
- ◆ Disconnect the JP3 connector from the Ajunc 2 Board.
- ◆ Clip the cable tie holding the input wires.
- ◆ Disconnect the input power. The input wires will need to be unsoldered from the top of the transformer.
- ◆ Remove the nuts holding the Power Supply in the Electronic Box.
- ◆ Remove the Power Supply, being careful not to lose any of the nuts, screws or plastic standoffs.
- ◆ If the unit has a Power Transistor attached to the Ajunc 2 Board, this will have to be removed [see sec. 10.17].
- ◆ The new Power Supply will need to be mounted to an adapter plate.
- ◆ Install the new Power Supply and adapter plate onto the screws and standoffs protruding from the back wall of the Electronic Box and secure in place with the nuts.
- ◆ Install female pins onto the input wires.
- ◆ Insert the wires in any order into a 3 pin female connector, using pin locations 1 and 3.
- ◆ Plug the input power connector into the Power Supply.

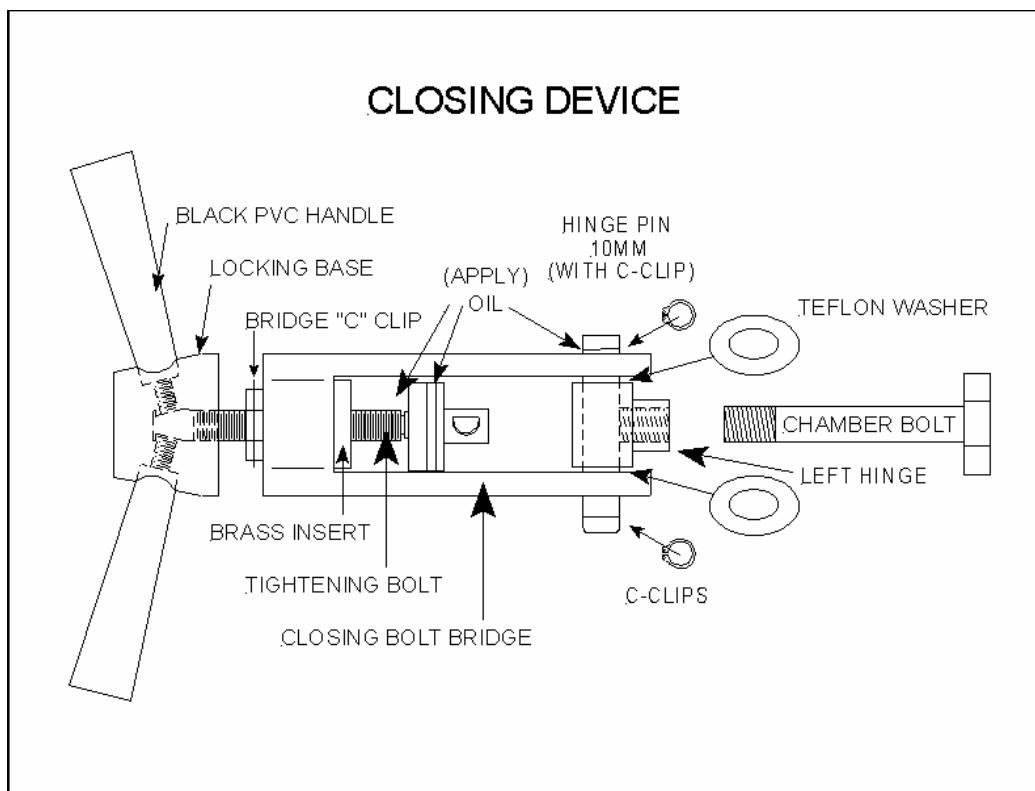
## 10.6 Closing Device

### 10.6.1 Closing Device Replacement

- ◆ Using C-clip pliers, remove the top and bottom C-clips.
- ◆ Remove the Hinge Pin, Teflon washers and Closing Device.
- ◆ Inspect the Hinge Pin by rolling it along a flat surface and observing any irregularities in its movement.
- ◆ If the Hinge Pin does not move straight and true, replace it.
- ◆ Inspect the C-clips. If any signs of damage or distortion are present, replace the C-clips.
- ◆ Install the new Closing Device so that the open end of the Closing Bridge C-clip is facing down.
- ◆ Position the Closing Device on the Hinge and insert the Teflon washers and the Hinge Pin.
- ◆ Install C-clips on the top and bottom of the Hinge Pin.

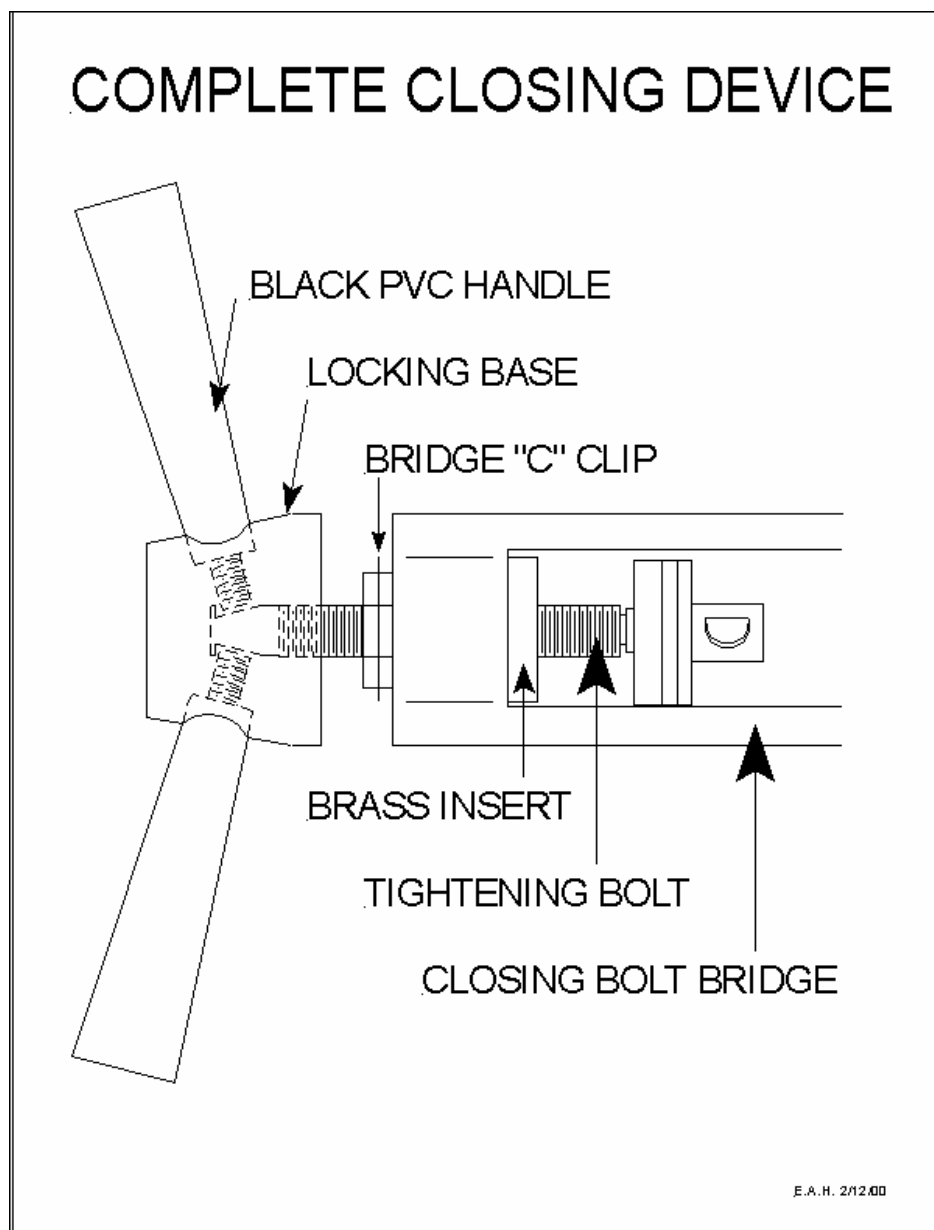
**WARNING:** Failure to install C-clips on the top and bottom of the Hinge Pin can result in the Hinge Pin sliding out of the Hinge. This will result in the failure of the safety locking system to maintain the Chamber seal, which can result in personal injury.

**NOTE:** When ordering a new 10MM Hinge Pin, the old style with two C-clips is no longer available. A new style can be substituted which uses a permanently affixed cap and cotter pin, part # LOK240-0019.



## 10.6.2 PVC Handle Replacement

- ◆ Remove the Closing Device from the autoclave.
- ◆ Unscrew the broken handle out of the Locking Base.
- ◆ Apply thread lock to the threads of the new handle.
- ◆ Screw the new PVC Handle into the Locking Base, making sure that the threaded shaft sits squarely on the flat of the Tightening Bolt.
- ◆ Using Test-4 (Brass Block), clamp the block onto the new handle.
- ◆ Place the block and handle into a vise.
- ◆ Using the body of the Closing Device, finish tightening the new handle being careful not to overtighten and crack the new handle.

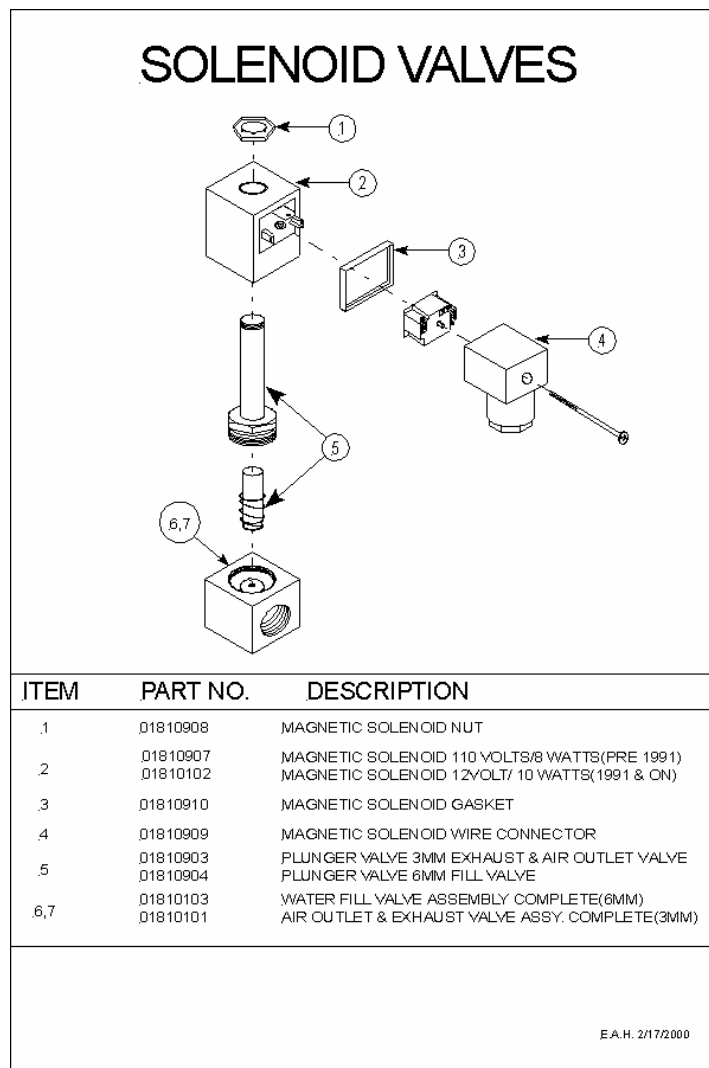




## 10.7 Solenoid Valve Replacement

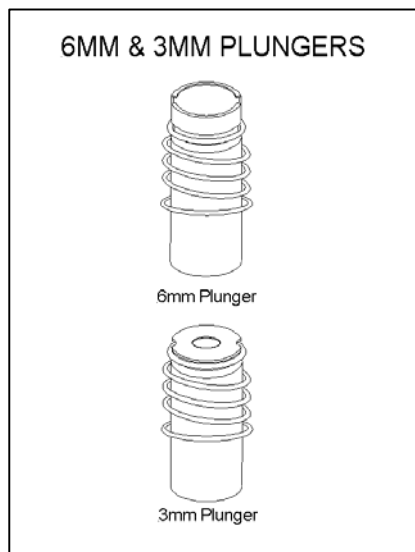
### 10.7.1 Replacing the Solenoid Coil

- ◆ Unplug the unit from the wall outlet.
- ◆ Remove the Outer Cabinet.
- ◆ Remove the screw holding the connection box to the Solenoid Coil.
- ◆ Unplug the connection box.
- ◆ Using a  $\frac{3}{4}$  inch wrench, loosen the retaining nut holding the Solenoid Coil, remove the Solenoid Coil.
- ◆ Using a small screwdriver, pry the connection box apart and inspect it to make sure the wires and connectors are tight and in position.
- ◆ Correct any problem connections and reassemble the connection box.
- ◆ Install the new Solenoid Coil and tighten down.
- ◆ Plug the connection box on to the Solenoid Coil and secure with the screw removed earlier.



## 10.7.2 Replacing the Plunger Assembly

- ◆ Unplug the unit from the wall outlet.
- ◆ Remove the Outer Cabinet.
  - If replacing the Fill Valve, make sure the Reservoir and Chamber are empty of any water.
  - If replacing the Exhaust Valve, make sure the Chamber is empty of any water.
  - If replacing the Dry Pump Valve, make sure the Chamber is empty of any water.
- ◆ Remove the Solenoid Coil by using a  $\frac{3}{4}$  inch wrench to loosen the retaining nut.
- ◆ Remove the Plunger Assembly using a  $\frac{7}{8}$ -inch wrench. **NEVER** use Vise Grips on the sleeve of the Plunger Assembly, doing so can damage the sleeve and cause the Plunger to malfunction.
- ◆ Clean any dirt or debris from the valve base.
- ◆ Using compressed air, blow out both the incoming and outgoing passageways in the base.
- ◆ Inspect the valve base for damage.
- ◆ Check the area where the Plunger seats, with a magnifying glass, for nicks or gouges that may cause leaking. If any damage is found, the base should be replaced.
- ◆ Install the new Plunger Assembly and tighten down with a  $\frac{7}{8}$ -inch wrench.
- ◆ There are two size Plungers, a 3mm and a 6mm. Typically, the Plunger Housings are marked on the end with a blue dot for 3mm and a green dot for 6mm.
- ◆ If, however, the markings are not apparent, measuring the seat once the Plunger is removed will make clear which one is the proper replacement.
- ◆ The Plungers do not require any lubrication.



## 10.8 SSR (Solid State Relay) Replacement

There can be up to three SSRs in the autoclave:

Heat SSR  
Dry Pump SSR  
Water Pump SSR

- ◆ Unplug the unit.
- ◆ Note the terminal number that each wire is attached to, remove the wires.
- ◆ One of the SSR mountings is a hole and the other is a slot. Loosen the screw that is in the slot and remove the screw that is in the hole.
- ◆ Remove the SSR.
- ◆ Apply thermal conductive grease to the metal plate on the back of the SSR.
  - The grease does not have to be very thick, a thin layer is fine.
  - Be sure to cover all the plate.
  - Not applying the grease can cause the new SSR to overheat and burn out.
- ◆ Install the new SSR the way the old SSR was removed.
- ◆ Tighten down the screws so that good contact is made between the metal plate of the SSR and the wall of the Electronic Box. Do not overtighten, that will cause the grease to be squeezed out.
- ◆ Reattach the wires exactly the way they were removed.

## 10.9 Air Jet Replacement

**NOTE** - There are two different Air Jets.

One is **black** for **M, E, EA, EZ** and **Valueklave** units.

One is **red** for **MK, EK, EKA, EZ10k** and all **3850** and all **3870** units.

The Air Jet is located in the Water Reservoir.

- ◆ Using a 10 mm wrench, remove the Air Jet from the mounting block.
- ◆ Clean the hole in the mounting block of any loose debris.
- ◆ Apply hydraulic sealing compound to the threads of the new Air Jet, being careful that no sealing compound gets into the Air Jet. (Teflon tape can be used but is not recommended because small bits of frayed tape can break off and clog the inner hole in the Air Jet).
- ◆ Carefully insert and thread the new Air Jet into the mounting block.
- ◆ Tighten down with the 10 mm wrench.

## 10.10 Water Sensing Electrode Replacement

- ◆ Unplug the unit.
- ◆ Empty any water that may be in the Chamber.
- ◆ Remove the back panel of the autoclave.
- ◆ Carefully push up the insulation at the back of the Chamber.
- ◆ Disconnect the small green wire attached to the back end of the Water Electrode.
- ◆ Loosen the compression nut at the back of the Chamber holding the Electrode in place.
- ◆ Remove the Water Sensing Electrode.
- ◆ Replace with a new Water Sensing Electrode.
- ◆ Gently tighten the compression nut so that the Electrode is held in place loosely.
- ◆ The Electrode should be loose enough so that it can be moved in and out easily but not fall out when released.
- ◆ Measure out  $\frac{3}{4}$  of the amount of water that the Chamber would normally be filled with [see sec. 2.4].
- ◆ Pour this measured amount of water into the empty Chamber.
- ◆ Adjust the Electrode so that the gold tip is just below the water line.
- ◆ Tighten the compression nut on the newly replaced Electrode, being careful not to overtighten.
- ◆ Reconnect the small green wire to the end of the Electrode.
- ◆ Empty the water from the Chamber.
- ◆ Adjust the automatic water fill as per the Operations or Technical Manual instructions [see sec. 8.6].

## 10.11 Door Bellows Replacement

The Door Bellows Assembly is located in a cavity of the Door, in the area that is engaged by the Closing Device.

There are two methods of removing the Door Bellows.

### ◆ Method 1 – Compressed air

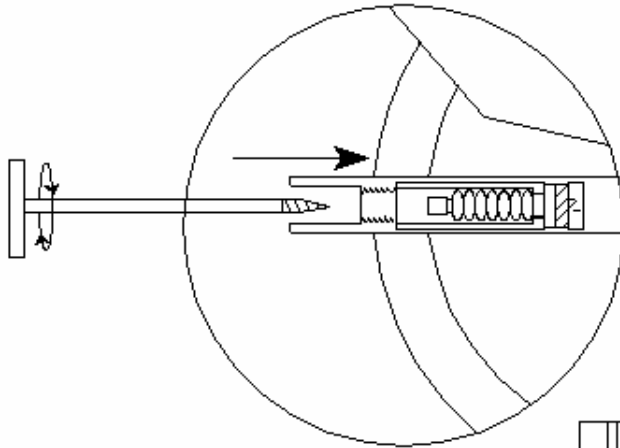
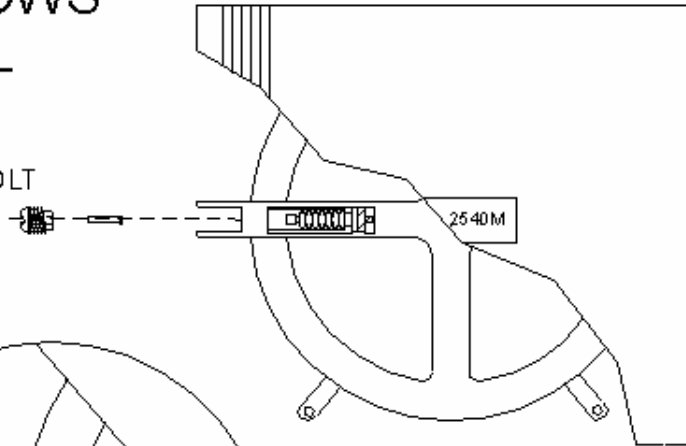
- Remove the Brass Housing Bolt from the Door.
- Locate the hole on the face of the Door that leads to the bellows cavity.
- Block the opening in the side of the Door where the Housing Bolt was removed with a thick book or block of wood. Care should be taken because the Bellows Assembly will be ejected with a great deal of force.
- Apply air pressure to the hole on the face of the Door.
- The air pressure will blow the Bellows Assembly out of the cavity.
- Check that the red washer has been removed from the bellows cavity, if not, reach into the door with a long thin screwdriver and remove the washer.
- Remove the old bellows from the brass housing.
- Insert the new Bellows Kit into the narrow end of the Brass Housing.
- Install the Brass Housing Bolt into the wider end of the Brass Housing.
- Insert the assembly into the Door.
- Tighten down the Housing Bolt; it needs only to be snug enough to seat the rear washer.

### ◆ Method 2 – Extraction

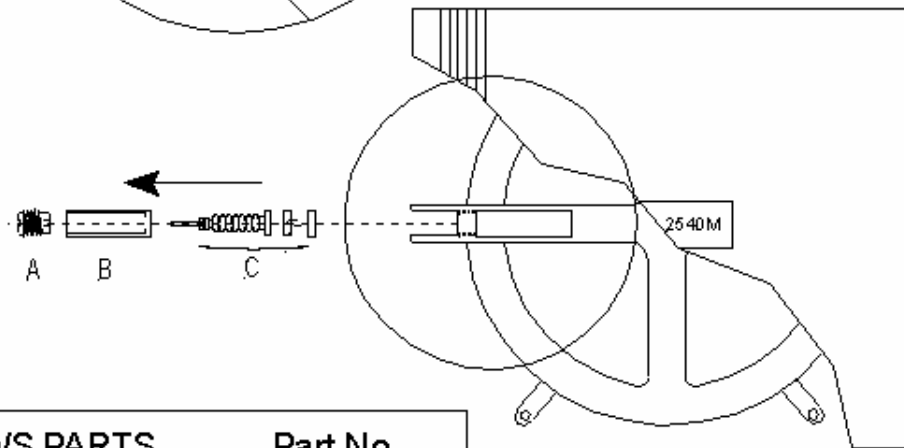
- Remove the Brass Housing Bolt from the Door.
- Remove the steel locking pin.
- Using the Bellows Extraction Tool or any 4 inch long drywall screw, insert the tool or screw into the bellows assembly until the brass bushing is reached.
- Thread the tool or screw into the center hole of the brass bushing one or two turns or until the threads have locked on to the bushing.
- Using the tool or screw, remove the Bellows Assembly from the Door.
- Check that the red washer has been removed from the Door, if not, reach into the door with the tool or screw and remove the washer.
- Remove the old bellows from the Brass Housing.
- Insert the new Bellows Kit into the narrow end of the Brass Housing.
- Install the Brass Housing Bolt into the wider end of the Brass Housing.
- Insert the assembly into the Door.
- Tighten down the Housing Bolt; it needs only to be snug enough to seat the rear washer.

# DOOR BELLOWS REMOVAL

REMOVE THE BELLOWS BOLT  
AND PULL THE PIN OUT.



USE THE BELLOWS EXTRACTOR  
TOOL OR A 4" DRYWALL SCREW  
TO REMOVE THE BELLOWS,  
BELLOWS HOUSING, BRASS  
BUSHING AND WASHER OUT.



BELLOWS PARTS	Part No.
A - DOOR BELLOWS BOLT	CT245010
B - DOOR BELLOWS HOUSING	CT241010
C - DOOR BELLOWS KIT	CT241111

(INCLUDES BELLOWS, PIN,  
BRASS BUSHING & WASHER)

E.A.H. 3/15/00

## 10.12 Chamber Replacement

Due to requirements by the **ASME** (American Society of Mechanical Engineers), it is not permitted to field replace any part of the Chamber Assembly.

The **ASME** certifies all the Chamber Assemblies in all the autoclaves Tuttnauer sells. This certification is our customer's assurance that the Chamber Assemblies have been manufactured from the best quality materials and tested with the highest integrity possible. In some cases, insurance coverage will be denied if the Chamber Assembly does not come with an **ASME** certification.

The **ASME** has stipulated that, in order to preserve the certification given any Tuttnauer autoclave, any Chamber Assembly replacement must be performed at the factory or factory branch office by trained technicians. This assembly work must be done according to a prescribed procedure and the Chamber Assembly must be properly hydrostatically tested.

Tuttnauer will accept stripped down machines for Chamber replacement. This type of repair will be expedited. Please call for details and proper Return Authorization.

## 10.13 Printer

### 10.13.1 Printer Replacement

- ◆ Unplug the unit.
- ◆ Remove the Outer Cabinet.
- ◆ Remove the Front Console assembly.
- ◆ Disconnect the Printer Ribbon Cable from the back of the Printer.
- ◆ Remove the two screws in the Printer Support Bracket and remove the bracket.
- ◆ Slide the Printer out through the front of the Console.
- ◆ Slide the new Printer into the same opening in the Front Console. If this is the first Printer to be installed in this machine, the opening will have a cover installed. Remove that cover and proceed.
- ◆ Install the bracket and secure with the two bracket screws.
- ◆ Connect the Printer Cable into the rear of the Printer.
- ◆ Make sure that dip switch # 8 on the Digital Predg Board is in the up position.
- ◆ Reinstall the Front Console and the Outer Cabinet.
- ◆ Plug the unit in.

### 10.13.2 Printer Paper Installation

- ◆ Remove the bezel on the front of the Printer.
- ◆ Pull out the printer draw.
- ◆ Install the paper roll on the post under the Printer. The roll should be installed with the paper flowing over the top of the roll toward the front of the Printer.
- ◆ The paper will curve up into the bottom of the printing mechanism.
- ◆ Use the **Feed Button** to advance the paper out from the front of the printing head.
- ◆ Slide the printer draw back into the machine.
- ◆ Make sure the microswitch on the underside of the circuit board is positioned to the left.
- ◆ Replace the Printer Front Bezel making sure the paper is positioned to come out the opening.
- ◆ The Printer is now ready to function.

**Note:** No parts are available for repairing the Printer



## 10.14 Dry Pump Replacement

- ◆ Unplug the unit.
- ◆ Remove the Outer Cabinet.
- ◆ Cut the two power leads going to the Dry Pump, at the butt connectors.
- ◆ Cut the plastic tie holding the Silicone Tube coming from the HEPA Filter and going to the top of the Dry Pump and remove the tube.
- ◆ Remove the three screws facing you that hold the Dry Pump to the “L” shaped bracket. One screw will have a green ground wire attached.
- ◆ Cut the plastic tie holding the Silicone Tube coming from the Dry Valve and going to the bottom of the Dry Pump and remove the tube.
- ◆ Remove the Dry Pump.
- ◆ Attach the Silicone Tube coming from the Dry Valve to the bottom of the new Dry Pump and secure with a plastic tie.
- ◆ Position the new Dry Pump on the bracket.
- ◆ Secure into position with the three mounting screws, remembering to reattach the green ground wire.
- ◆ Attach the Silicone Tube coming from the HEPA Filter to top of the Dry Pump and secure with a plastic tie.
- ◆ Connect the two wires from the Dry Pump, to those cut earlier, using crimp connectors.
- ◆ If the replacement pump is the newer style, remove the rubber feet from the old pump bracket and attach them to the new pump. Mount the new pump using the original mounting holes and screws.
- ◆ Connect the silicone tubing observing the directional arrows. The in port from the HEPA Filter is typically on top and the out port to the Dry Valve is on the bottom. Secure with plastic ties.
- ◆ Connect the two power wires using crimp connectors.

## 10.15 Safety Relief Valve Replacement

The Safety Relief Valve (or Pressure Relief Valve) is located in the Water Reservoir.

- ◆ Using a  $\frac{3}{4}$  inch wrench, remove the Safety Relief Valve from the mounting block.
- ◆ Clean the hole in the mounting block of any loose debris.
- ◆ Apply hydraulic sealing compound to the threads of the new Safety Relief Valve. Be careful that no sealing compound gets into the Safety Relief Valve. (Teflon tape can be used but is not recommended, because small bits of frayed tape can break off and clog the inner hole in the Safety Relief Valve).
- ◆ Carefully insert and thread the new Safety Relief Valve into the mounting block.
- ◆ Tighten down with the  $\frac{3}{4}$  inch wrench.

## 10.16 Float Switch Replacement

- ◆ The Float Switch is located in the Water Reservoir.
- ◆ Unplug the unit.
- ◆ Drain the Water Reservoir.
- ◆ Disconnect or cut the two wires going to the Float Switch.
- ◆ Unscrew the plastic nut on the outside of the Reservoir.
- ◆ Remove the Float and rubber washer from inside the Reservoir.
- ◆ Install the rubber washer on the new Float.
- ◆ Insert the new Float, with washer, into the hole from inside the Reservoir.
- ◆ Loosely screw on the plastic nut from outside the Reservoir.
- ◆ Before tightening the plastic nut, make sure the Float is oriented correctly. The Float should move up and down freely.
- ◆ Attach an ohmmeter to the Float leads and check that when in the up position the meter shows continuity. When in the down position the meter should show an open circuit.
- ◆ Tighten the plastic nut to insure the Float will not move or leak.
- ◆ Reconnect the Float wires using either the connectors provided or by crimp connecting the wires.

## 10.17 Power Transistor Replacement

- ◆ Unplug the unit.
- ◆ Remove the Outer Cabinet.
- ◆ Remove the Front Console.
  - Unplug the large ribbon cable connected to the Ajunc 2 Board.
  - Unplug the green ground wire.
  - Remove the On/Off Switch from the Front Console.
- ◆ Note the location of and unplug any connectors plugged into the Ajunc 2 Board.
- ◆ Remove solder from the two connection posts of the Power Transistor on the front of the Ajunc 2 Board.
- ◆ Remove the Ajunc 2 Board from the Electronic Box.

The Ajunc 2 Board will either have four mounting screws or three plastic push on connectors and one mounting screw, which also secures a ground wire to the Ajunc 2 Board.
- ◆ Remove the two screws securing the Power Transistor to the Electronic Box.
- ◆ Remove the Power Transistor.
- ◆ Apply **Heat Transfer Compound** to the underside of the Power Transistor (a small amount is all that is needed).
- ◆ Position the new Power Transistor onto the rear of the Electronic Box.
- ◆ Secure the Power Transistor to the Electronic Box using the two screws removed earlier.
- ◆ Reinstall the Ajunc 2 Board into the Electronic Box using either screws or push on connectors.
- ◆ Solder the two connection posts of the Power Transistor protruding through the front of the Ajunc 2 Board.
- ◆ Replug all the connectors into their proper locations on the Ajunc 2 Board.
- ◆ Reinstall the Front Console.
  - Connect the large ribbon cable to the Ajunc 2 Board.
  - Connect the green ground wire.
  - Install the On/Off Switch.
- ◆ Power the unit up and check for proper +5 volts DC.

## 10.18 Ajunc Board Replacement

### 10.18.1 Ajunc Board without a Power Transistor

- ◆ Unplug the unit.
- ◆ Remove the Outer Cabinet.
- ◆ Remove the Front Console.
  - Unplug the large ribbon cable connected to the Ajunc Board.
  - Unplug the green ground wire.
  - Remove the On/Off Switch from the Front Console.
- ◆ Note the location of and unplug any connectors plugged into the Ajunc Board.
- ◆ Remove the Ajunc Board from the Electronic Box.

The Ajunc Board will either have four mounting screws or three plastic push on connectors and one mounting screw which also secures a ground wire to the Ajunc Board.
- ◆ Install the new Ajunc Board into the Electronic Box using either screws or push on connectors.
- ◆ Replug all the connectors into their proper locations on the Ajunc Board.
- ◆ Reinstall the Front Console.
  - Connect the large ribbon cable to the Ajunc Board.
  - Connect the green ground wire.
  - Install the On/Off Switch.

### 10.18.2 Ajunc Board with a Power Transistor

- ◆ Unplug the unit.
- ◆ Remove the Outer Cabinet.
- ◆ Remove the Front Console.
  - Unplug the large ribbon cable connected to the Ajunc 2 Board.
  - Unplug the green ground wire.
  - Remove the On/Off Switch from the Front Console.
- ◆ Note the location of and unplug any connectors plugged into the Ajunc 2 Board.
- ◆ Remove solder from the two connection posts of the Power Transistor on the front of the Ajunc 2 Board.
- ◆ Remove the Ajunc 2 Board from the Electronic Box.
- ◆ The Ajunc 2 Board will either have four mounting screws or three plastic push on connectors and one mounting screw, which also secures a ground wire to the Ajunc 2 Board.

- ◆ If you are replacing the Power Transistor, remove the two screws securing the Power Transistor to the Electronic Box and remove the Power Transistor.
  - Apply **Heat Transfer Compound** to the underside of the new Power Transistor (a small amount is all that is needed).
  - Position the new Power Transistor onto the rear of the Electronic Box.
  - Secure the Power Transistor to the Electronic Box using the two screws removed earlier.
- ◆ Install the new Ajunc 2 Board into the Electronic Box using either screws or push on connectors.
- ◆ Solder the two connection posts of the Power Transistor protruding through the front of the Ajunc 2 Board.
- ◆ Replug all the connectors into their proper locations on the Ajunc 2 Board.
- ◆ Reinstall the Front Console.
  - Connect the large ribbon cable to the Ajunc 2 Board.
  - Connect the green ground wire.
  - Install the On/Off Switch.
- ◆ Power the unit up and check for proper +5 volts DC.

## 10.19 Digital Predg Board Replacement

- ◆ Unplug the unit.
- ◆ Remove the Outer Cabinet.
- ◆ Remove the Front Console.
  - Unplug the large ribbon cable connected to the Ajunc Board.
  - Unplug the green ground wire.
  - Remove the On/Off Switch from the Front Console.
- ◆ Remove the four nuts from inside the Front Console holding the Digital Predg Board and Keypad assembly in place and remove that assembly.
- ◆ If you are not replacing the Keypad, remove the five nuts and one brass post holding the Keypad and Digital Predg Board together. Disconnect the small ribbon cable located at JP4 on the Digital Predg Board.
- ◆ Install the Keypad onto the new Digital Predg Board and secure with the five nuts and one brass post. Reconnect the small ribbon cable to the JP4 connector.
- ◆ Install the new Digital Predg Board assembly into the Front Console and secure with the four nuts removed previously.
- ◆ Adjust the Dip Switches on the new Digital Predg Board to match the Dip Switches on the old board. (The Dip Switches are located near the bottom of the board just above the printer connector).
- ◆ If you have not ordered a new Microprocessor (the Digital Board does not come with a Microprocessor), remove the old one from the old Digital Predg Board and install it into the new board. Be sure to use the proper extraction tool so as not to damage the chip. The chip will only fit in properly one way, do not force it.
- ◆ Reinstall the Front Console.
  - Connect the large ribbon cable to the Ajunc Board.
  - Connect the green ground wire.
  - Install the On/Off Switch.

## **10.20 Door Assembly Replacement**

Due to requirements by the **ASME** (American Society of Mechanical Engineers) it is not permitted to field replace any part of the Chamber Assembly. The Door Assembly is part of the Chamber Assembly and as such is not field replaceable.

The **ASME** certifies all the Chamber/Door Assemblies in all the autoclaves Tuttnauer sells. This certification is our customer's assurance that the Chamber/Door Assemblies have been manufactured from the best quality materials and tested with the highest integrity possible. In some cases, insurance coverage will be denied if the Chamber/Door Assembly does not come with an **ASME** certification.

The **ASME** has stipulated that in order to preserve the certification given any Tuttnauer autoclave, when any part of the Chamber/Door Assembly needs replacement, it must be performed at the factory or factory branch office by trained technicians. This assembly work must be done according to a prescribed procedure and the Chamber/Door Assembly must be properly hydrostatically tested.

Tuttnauer will accept machines for Door Assembly replacement as an expedited repair. Please call for details and proper Return Authorization.



## 10.21 Fan Replacement

- ◆ Unplug the autoclave.
- ◆ Remove the Outer Cabinet.
- ◆ Disconnect the flat ribbon cable and the green ground wire going to the Front Console Panel.
- ◆ Remove the Front Console Panel (one screw on top, one screw on the bottom).
- ◆ Disconnect all connectors going to the Electronic Box.
- ◆ Remove the Electronic Box (one screw on top, two screws on the bottom).
- ◆ Disconnect the Fan from JP5 or JP10 or JP15 depending on the model autoclave.
- ◆ From the bottom of the Electronic Box, remove the four screws holding the Fan.
- ◆ Replace the Fan.
- ◆ Repeat the previous steps in the reverse order to reassemble the unit.

## 10.22 Water Pump Replacement

- ◆ Unplug the unit.
- ◆ Drain the Reservoir.
- ◆ Remove the Outer Cabinet.
- ◆ Unplug the two power leads at the Water Pump.
- ◆ Also disconnect the leads going to the Water Pump Capacitor mounted to the support leg of the Reservoir.
- ◆ Cut the plastic tie holding the Silicone Tube going from the Water Pump to the Fill Valve.
- ◆ Remove the two screws securing the Water Pump to the Chassis.
- ◆ Cut the plastic tie holding the Silicone Tube coming from the Pump Strainer and going to the Water Pump.
- ◆ Remove the Water Pump.
- ◆ Remove the Water Pump Capacitor.
- ◆ Install a new Water Pump Capacitor.
- ◆ Attach the Silicone Tube coming from the Pump Strainer to the new Water Pump and secure with a plastic tie.
- ◆ Position the new Water Pump.
- ◆ Secure into position with the two mounting screws.
- ◆ Attach the Silicone Tube coming from the new Water Pump to the Fill Valve and secure with a plastic tie.
- ◆ Connect the two wires from the Water Pump Capacitor and the two power leads removed earlier.

## 10.23 Fuse and Fuse Holder Replacement

### 10.23.1 Fuse Replacement

- ◆ Unplug the autoclave.
- ◆ Insert a flat blade screwdriver into the Fuse Cap.
- ◆ Press in and twist  $\frac{1}{4}$  turn to the left.
- ◆ The Fuse Cap will release and the Fuse and Cap can be removed.
- ◆ A new Fuse can be inserted into the Fuse Cap.
- ◆ Insert the Fuse and Cap into the Fuse Holder.
- ◆ Press in and twist to the right, this will lock the Fuse and Cap in place.

**Note:** A mini fuse with a black Fuse Cap can be replaced with a standard size fuse ( $\frac{1}{4}$  x  $1\frac{1}{4}$ ) and a gray Fuse Cap.

### 10.23.2 Fuse Holder Replacement

- ◆ Unplug the autoclave.
- ◆ Slip the silicone sleeve on the back of the Fuse Holder back over the two wires connected to the Fuse Holder.
- ◆ Disconnect the two wires on the back of the Fuse Holder.
- ◆ Unscrew the locking nut on the back of the Fuse Holder.
- ◆ Remove the Fuse Holder.
- ◆ Install the new Fuse Holder.
- ◆ Secure with the locking nut.
- ◆ Reconnect the two wires to the back of the Fuse Holder.
- ◆ Reposition the silicone sleeve on the back of the Fuse Holder; this sleeve protects against accidental shorting.

## 10.24 Circuit Breaker Replacement

- ◆ Unplug the autoclave.
- ◆ Label the four wires on the back of the Circuit Breaker.
- ◆ Remove the four wires from the back of the Circuit Breaker.
- ◆ Remove the four screws on the front of the mounting plate.
- ◆ Remove the Circuit Breaker.
- ◆ Install the new Circuit Breaker.
- ◆ Secure in position with the four screws.
- ◆ Reinstall the four wires onto the back of the Circuit Breaker, making sure they are in the same position as before.

## 11 Component Function in the Autoclave

### 11.1 Temperature Safety Thermostat

There are two safety thermostats installed on the autoclave. One is called the **Temperature Safety Thermostat** and the other is called the **Cut-Out Thermostat**. These two devices have been used in the autoclave since 1993 to monitor external Chamber temperature. They are set at the factory for **two** different and distinct temperature ranges.

The Temperature Safety Thermostat and Cut-Out Thermostat are installed in the autoclave to protect the unit from overheating and damaging the contents of the Chamber, as well as to protect the autoclave from damaging itself or its surroundings.

\*\*\*\* For the proper installation procedure of this device see sec. 10.2.

\*\*\*\* For the proper testing procedures for this device see sec. 8.8.

\*\*\*\* **These devices are set at the factory using a special procedure – DO NOT try to recalibrate these devices, if broken they should be replaced**

The **Temperature Safety Thermostat** is an automatic resetting device. It is designed to protect against overheating should the external temperature of the Chamber reach between 180 and 200 deg C.

The device itself consists of a contact box located next to the incoming power at the back of the machine and a sensing probe located in the lower channel of the rearmost Heating Element. The sensing probe and the tube leading back to the contact box are filled with liquid. It is important that they not be punctured or kinked since this will cause the device to operate incorrectly. When tightened, the Heating Element will hold the probe tight against the external wall of the Chamber.

On autoclaves with Microprocessors earlier than T93N3 this device is wired to the high voltage line in series with the Heating Elements. Should the Chamber reach this temperature, the Heating Elements will be turned off and the rest of the machine will remain on. Once the Chamber has cooled, the device will automatically reset itself and the cycle will continue as if nothing had happened. In this way, the Heating Elements can be turned off and on directly to control any overheating situation while minimizing any interference in the normal cycle operation.

For units with microprocessors T93N3 or later, the Temperature Safety Thermostat is wired into the Microprocessor and the Microprocessor uses this information in controlling overheating during the Dry Cycle. In addition, information sent to the Microprocessor from the Temperature Safety Thermostat and the Water Sensing Electrode is used to detect a Low Water condition in the Chamber. The Low Water message is displayed and the cycle aborted, when the Temperature Safety Thermostat detects an overheating of the Chamber **and** the water in the Chamber no longer covers the tip of the Water Sensing Electrode.

## 11.2 Cut-Out Thermostat

There are two safety thermostats installed on the autoclave. One is called the **Temperature Safety Thermostat** and the other is called the **Cut-Out Thermostat**. These two devices have been used in the autoclave since 1993 to monitor external Chamber temperature. They are set at the factory for **two** different and distinct temperature ranges.

The Temperature Safety Thermostat and Cut-Out Thermostat are installed in the autoclave to protect the unit from overheating and damaging the contents of the Chamber as well as to protect the autoclave from damaging itself or its surroundings.

\*\*\*\* For the proper installation procedure of this device see sec. 10.2.

\*\*\*\* For the proper testing procedures for this device see sec. 8.9.

\*\*\*\* **These devices are set at the factory using a special procedure – DO NOT try to recalibrate these devices, if broken they should be replaced**

The **Cut-Out Thermostat** is a manually reset device set to detect external Chamber temperatures of between 220 and 240 deg C. It is the final fail-safe device in case of an overheating condition.

The device itself consists of a contact box located next to the incoming power at the back of the machine and a sensing probe located in the upper channel of the rearmost Heating Element. The sensing probe and the tube leading back to the contact box are filled with liquid. It is important that they not be punctured or kinked since this will cause the device to operate incorrectly. When tightened, the Heating Element will hold the probe tight against the external wall of the Chamber.

On all units, the Cut-Out Thermostat is connected directly to the high voltage line coming into the autoclave. If the Cut-Out Thermostat detects an over temperature and becomes activated, all power to the autoclave will be turned off. The only way to restore power is for the operator or service technician to wait for the unit to cool down and press in the red reset button at the back of the machine. It may be necessary, in some cases, to use a pencil point or similar object to completely push in the reset button. When pushed in the button may or may not stay in, however, a small click will be heard.

## 11.3 Air Jet

The main function of the Air Jet is to allow the air inside the Chamber to escape during the heat up stage.

All gravity type sterilizers, like those in the Tuttnauer line, have some kind of an air bleed device.

If the air inside the Chamber is not allowed to escape, the temperature in the Chamber will not rise properly. In addition, pockets of air will form inside the Chamber that have a temperature lower than the surrounding steam. Both of these conditions will lead to a failed sterilization cycle.

With the unit set to sterilize at 273°F, but with the Air Jet blocked off, just as it would be if it were not cleaned, the autoclave would run and the pressure may reach 30 psi, but the temperature would only reach about 260°F. This temperature is 13°F below the programmed sterilization temperature. The cycle would fail as well as any spore testing that was done.

**It is vitaly important that the air jet be kept clean.**

**Clean at least once per week as per the instructions in sec. 6.5.**

There is a second important function for the Air Jet, which is to allow the steam from inside the Chamber to purge out. The Air Jet will allow the steam to purge all during the cycle. The steam purging out creates a motion inside the Chamber. The motion inside the Chamber causes the steam to circulate and mix and that evens out the temperature all through the Chamber. An even temperature means that sterilization will be the same throughout the Chamber. If the Air Jet were to shut down and not allow this purging, the steam would be trapped in the Chamber motionless. This motionless steam, with the help of the Heating Elements turning on and off, can lead to hot and cold pockets of steam within the Chamber causing uneven sterilization.

## 11.4 Water Sensing Electrode

The Water Sensor is located inside the Chamber in the rear. It typically sticks up between  $\frac{1}{4}$  and  $\frac{1}{2}$  inch from the bottom of the Chamber, but the proper depth setting is determined by a specific procedure.

The Water Sensor is made up of a gold plated metal stud with a Teflon sleeve. The tip of the stud sits above the top of the sleeve. The Water Sensor is connected by a wire to the Microprocessor. The Water Sensor only detects water when the water touches the tip. When water touches the tip, the water grounds the signal from the Microprocessor and in this way the Microprocessor knows that water is in the Chamber.

The Water Sensing Electrode is used to check for the proper filling of the Chamber at the beginning of the cycle and to monitor the water level in the Chamber during the cycle.

The Water Sensor does this in different ways, depending on the age of the autoclave.

In units that have the first four digits of their serial numbers between 9301 and 0003, the Water Sensor is designed to regulate the water filling process by determining the proper depth of the water in the Chamber. In these machines, the Chamber is filled by a gravity flow from the Reservoir.

In addition, the Water Sensor can determine if, during the sterile cycle, the water has gone below a critical level. It does this in conjunction with the Temperature Safety Thermostat. If the tip of the Water Sensor has become exposed and the Temperature Safety Thermostat detects an overheating of the Chamber, the cycle is aborted and a **LOW WATER** message is displayed.

In units that have serial numbers starting with 0003 and higher, the Water Sensor is again used to check filling but it does not set a depth. The Water Sensor only registers the fact that water is in the Chamber. The filling is accomplished by a timed pump.

As before, the Water Sensor can determine if, during the sterile cycle, the water has gone below a critical level. It does this in conjunction with the Temperature Safety Thermostat. If the tip of the Water Sensor has become exposed and the Temperature Safety Thermostat detects an overheating of the Chamber, the cycle is aborted and a **LOW WATER** message is displayed.

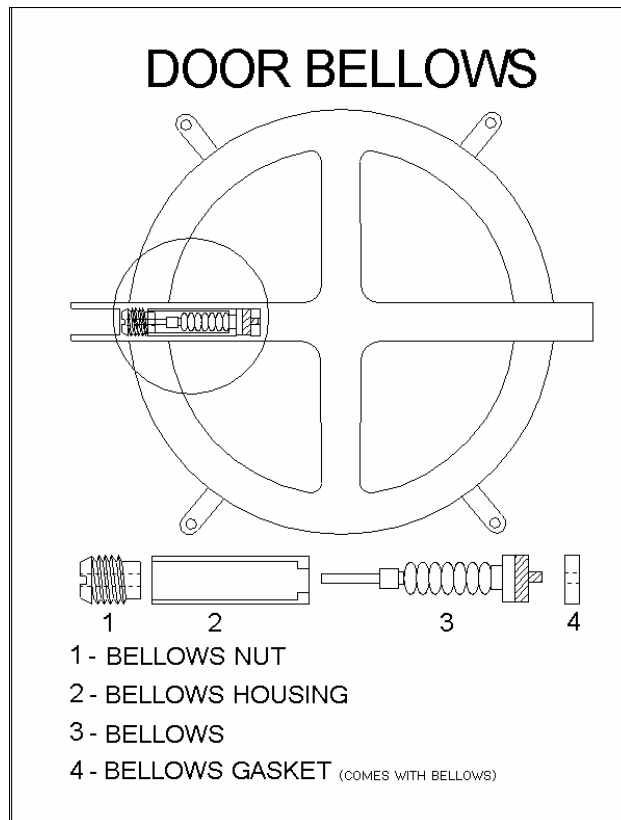
## 11.5 Door Bellows

The function of the Door Bellows Assembly is to insure that the Door remains closed while there is pressure inside the Chamber.

The Door Bellows Assembly consists of several parts:

Bellows Housing Bolt  
Bellows Housing  
Bellows Locking Pin  
Silicone Bellows  
Brass Bushing  
Washer

The Door Bellows Assembly is located in a cavity of the Door, in the area which is engaged by the Closing Device. There is an access hole to this cavity on the face of the Door. As steam pressure builds, the pressure is allowed into the bellows cavity and expands the flexible Silicone Bellows. This pushes the metal Locking Pin out through a hole in the Housing Bolt and into one of the notches on the Closing Device. This action locks the Closing Device and prevents the Door from being opened while pressure remains in the Chamber. When the pressure in the Chamber is released, the spring like action of the Silicone Bellows pulls the Locking Pin back, releasing the Closing Device.





## 11.6 Air Outlet Valve

The Air Outlet Valve is an electronic solenoid valve mounted on the rear of the Water Reservoir.

This Air Outlet Valve has several different functions.

- ◆ During the **Filling phase**, the Air Outlet Valve is open to allow for the smooth flow of water from the Reservoir. Without this valve, water flowing into a hot Chamber would immediately produce steam and pressure. The pressure would push on the water, stopping it from entering the Chamber. This would result in an incomplete fill and the inability of the autoclave to complete a cycle.
- ◆ During the **Heat up phase**, the Air Outlet Valve is open to assist the Air Jet in removing any air from inside the Chamber. Air trapped inside the Chamber will cause cold spots as well as a general difficulty in reaching the proper sterilization temperature. Once the temperature reaches 195°F, the Air Outlet Valve closes and any remaining air finishes exiting through the Air Jet.
- ◆ During the **Sterilization phase**, the Air Outlet Valve remains closed, unless the pressure rises above 34 psi. In this case, the Air Outlet Valve will open for one second to emit a short blast of steam to stabilize the Chamber pressure.
- ◆ The Air Outlet Valve will open at the end of the **Exhaust phase** to release the final 3 pounds of steam pressure.
- ◆ During the **Drying phase**, the Air Outlet Valve is open to allow the heat and steam to escape from the drying packs.

## 11.7 Printer

The purpose of the Printer is to establish a printed record of a sterilization cycle.

The Printer will print out any and all information that is present on the autoclaves Display. This includes temperature and pressure readings as well as all error messages.

A typical Printer tape will look like this:

```
AUTOCLAVE NO:1
LOAD NO:0005
OPERATOR:
OK
D31 203° F 00P
D28 244° F 00P
E27 236° F 04P
E25 266° F 19P
S25 274° F 30P
S24 274° F 31P
S23 274° F 30P
S22 274° F 30P
S21 274° F 31P
S20 274° F 30P
S19 274° F 31P
S18 273° F 29P
H17 268° F 26P
H13 244° F 15P
H09 212° F 05P
H05 160° F 00P
H01 120° F 00P
MN TEMP PRES
DRY :05min
TIME:07min
TEMP:273° F
PROG:PKG
TIME:09:48:43
DATE:10:08:07
Version:T04EAWP
```

The Printer tape reads from the bottom up.

The first item that is printed out is the version number of the Microprocessor for that autoclave.

Next is printed the date and time.

The name of the program that was selected is printed, as well as the temperature, sterilization time and dry time parameters that are part of that program.

Three columns are formed; the left most column is minutes, the center column is temperature and the right column is pressure.

The letters preceding each of the minute entries stand for **H**eat-up, **S**terilization, **E**xhaust and **D**ry.

During the **H**eat-up phase the temperature and pressure are printed out every 4 minutes.

During the **S**terilization phase the temperature and pressure are printed out every 1 minute.

During the **D**ry phase the temperature and pressure are printed every 3 minutes.

The temperature reading during the Dry phase should not be regarded as completely accurate. This is due to the fact that the temperature sensor is designed to react mainly to steam temperature and during the Drying phase there is no steam present. This is not of consequence since the Dry phase is not regulated by temperature; it is strictly the result of a preset duty cycle for the Heating Elements.

At the end of a successful cycle, the Printer will print out “O.K.”

A space is available for the operator to write their initials.

The sequential number of the load is printed. This number cycles up to 256 and then back to 0.

Lastly, the autoclave number is printed. This number can be from 1 to 4 and can be set by a technician. If more than one autoclave is installed at a facility, this will be a good way to match printer tapes to the proper machine.

```
AUTOCLAVE NO:1
LOAD NO:0002
OPERATOR:
E11 198°F 02P
FAIL
MAN STOP
F11 198°F 02P
H09 180°F 00P
H05 111°F 00P
H01 074°F 00P
MN TEMP PRES
DRY :00min
TIME:10min
TEMP:273°F
PROG:INS
TIME:15:25:44
DATE:10:09:07
Version:T04EAWP
```

Note the example of a Printer tape where the cycle failed.

This cycle was aborted by pressing the **STOP Key**, hence the **MAN STOP** message followed by a **FAIL** message. The **FAIL** message does not appear on the autoclave display, it only appears on a print out.

Note also the “F” in front of the minute entry. This shows the temperature and pressure where the failure occurred.

The information that comes from the Printer is not only good for record keeping; it also makes the Printer a valuable diagnostic tool for the technician.

## **11.8 Fuse & Circuit Breaker**

The purpose of a Fuse or Circuit Breaker in the autoclave is the same. They are there to protect against any kind of electrical short circuit. If a live wire inside the unit were to come into contact with the chassis or any metal in the unit, a direct short would be produced and the Fuse would blow or the Circuit Breaker would be tripped.

Additionally, these devices provide protection from arcing that can occur across a contact inside one of the switches, or across a terminal connection. This arcing would cause an increase in the current drawn by the autoclave, resulting in a blown Fuse or tripped Circuit Breaker. This protective action would save the unit and any operator from further damage or injury.