tuttnauer USA Co.

Sterilization & Infection Control Products

Technicians Service and Repair Manual for the "E" Series Tuttnauer Autoclave

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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Table of Contents

6 Maintenance

7 Trouble Shooting

8 Testing and Calibration

9 Tables and Diagrams

10 Replacement

11 Component Function in the Autoclave

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 avaliable 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 18"; 15" x 20"
and 15" x 27"

Automatic models:

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

Chamber sizes: 7" x 12"; 9" x 18";
(diameter x depth) 10" x 18"; 15" x 20"
and 15" x 27"

Tuttnauer offers a wide variety of standard models of autoclave, 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 then 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 for new autoclaves covers both parts and labor.

Tuttnauer warrantees 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 charge 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.

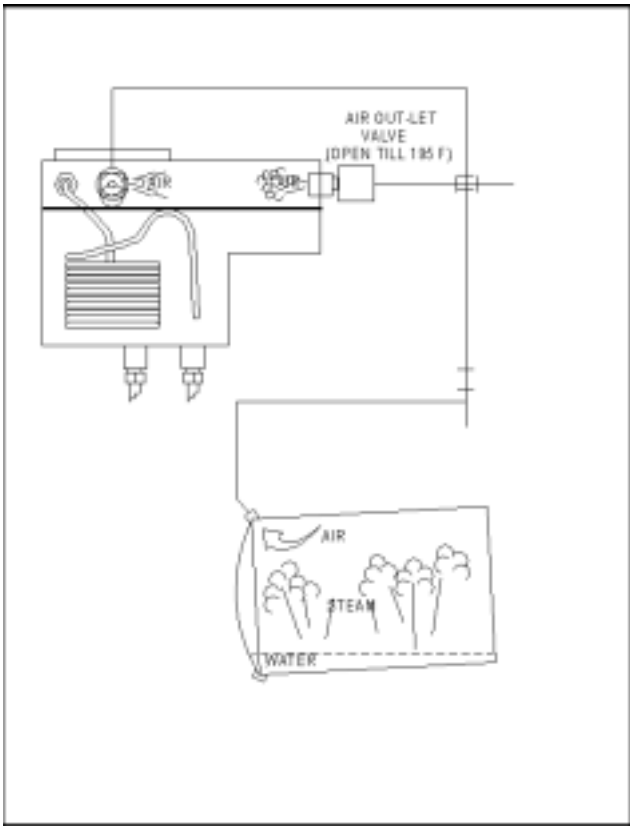
No other warranties or obligations are expressed or implied.

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, that is that there must be 0% air 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 can not be understated. The Air Jet has two important functions.
First is to remove the air from in side 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 temperature. 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.
In addition the Air Jet has a second function, that 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. It 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.
Forth, 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, which allows the water to flow smoothly.
3. The autoclave heats to the proper temperature controlled by the temperature and pressure sensor. The air outlet valve closes at 195^0F. Air escapes the Chamber through the Air Jet
4. Once 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 counter top. 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 to close steam damage can occur to the underside of the cabinets.

A minimum 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 <u>without</u> Water Pumps

These units will have Microprocessors with date codes 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 is one of the most important things you can do for the sterilizer. Proper Chamber pitch insures that among other things 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 to 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 – 12oz (300ml – 360ml)
2340 = 12 oz – 15oz (350ml – 440ml
2540 = 12 oz – 15oz (350ml – 440ml)
3850 = 20 oz – 23oz (600ml – 680ml)
3870 = 24 oz – 27oz (750ml – 800ml)

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 check if the automatic filling is set correctly.

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
Then 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 then 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
Then release the button – wait ten seconds – the unit is now reprogrammed.

2.4.2 Setup and Automatic Filling for units with Water Pumps

Any unit with a Microprocessor date code 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.
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, then 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:

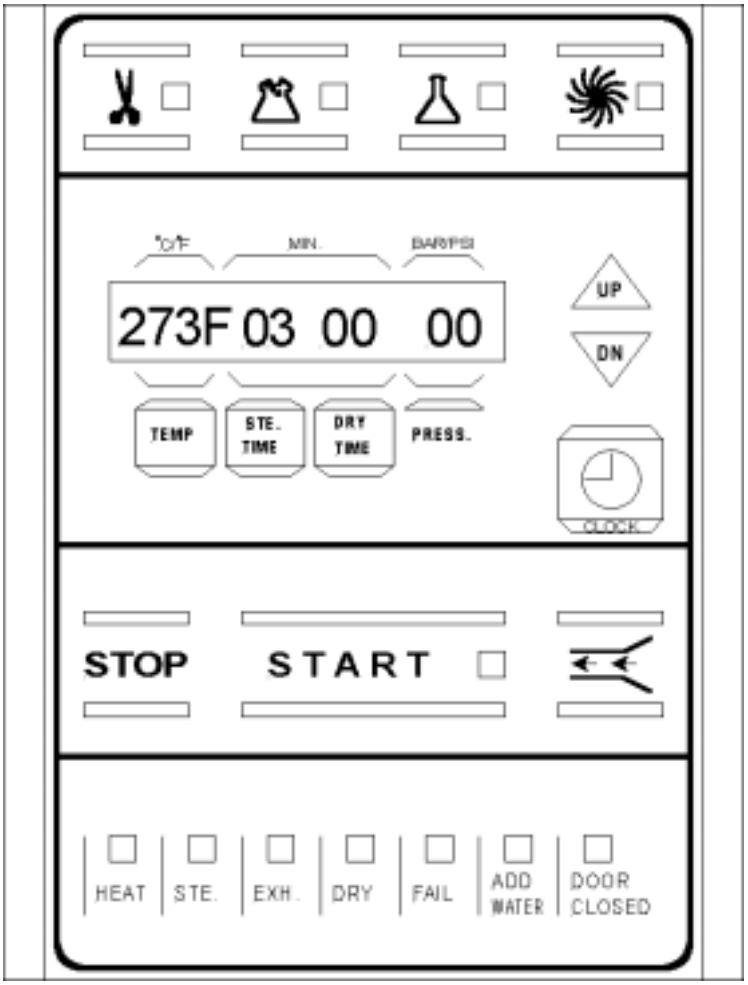
   2340 = 30 sec
   2540 = 35 sec
   3870 = 65 sec

   now press the **STOP Key**
5. 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.
6. 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



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 lock-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 ^{0}F for temperature
3 minutes of sterilization time
rapid exhaust
no drying time

Wrapped Instruments – symbolized by a gown
the default parameters are
273 ^{0}F for temperature
7 minutes of sterilization time
rapid exhaust
30 minutes of drying time

Liquids – symbolized by a flask
the default parameters are
250 ^{0}F for temperature
30 minutes of sterilization time
slow exhaust only
no dry time, drying is not allowed

Extra Drying Cycle – symbolized by the sun
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 then 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, 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, 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 **Liquid** 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 250^0F and 274^0F (121^0C and 134^0C). For liquids the maximum temperature is 250^0F (121^0C)

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, press and hold the **TEMP Key** and turn the power on.

STE TIME –

The **STE TIME Key** is used to change the sterilization time parameter of the **Wrapped**, **Unwrapped** or **Liquid** 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** and **Unwrapped** 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 an including Microprocessors dated T93N6) or from psi to kpa (on all machines with Microprocessors dated T96DN1 or T97DN6 or later)

CLOCK Key –

Pressing the **CLOCK Key** first displays 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 then 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 then 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 will 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 which ever 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, EZ, 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

Any time 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 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. 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, the Cycle Fail indicator lights and the cycle is aborted if the temperature drops 2.5 ^{0}C (4.5 ^{0}F) 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 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 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 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 ^{0}F (5 ^{0}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 any time 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 ^{0}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 date coded 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, then 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, then when power is restored, the autoclave will check if the temperature in the Chamber has fallen more than 4.5 ^{0}F (2.5 ^{0}C). If not then the Sterilization Cycle will resume automatically. If however, when the power returns, the system determines that the temperature has fallen more than 4.5 ^{0}F (2.5 ^{0}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 then 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 accidentally opens 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

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 & 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 & 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 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 heat proof glass. The beaker should only be filled 2/3 full and the lid should be on loosely to allow for expansion (see the table 9.8 for the maximum liquid capacity for each model)

19. If spotting is 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 then 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 then 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 a distilled water or alcohol bath.

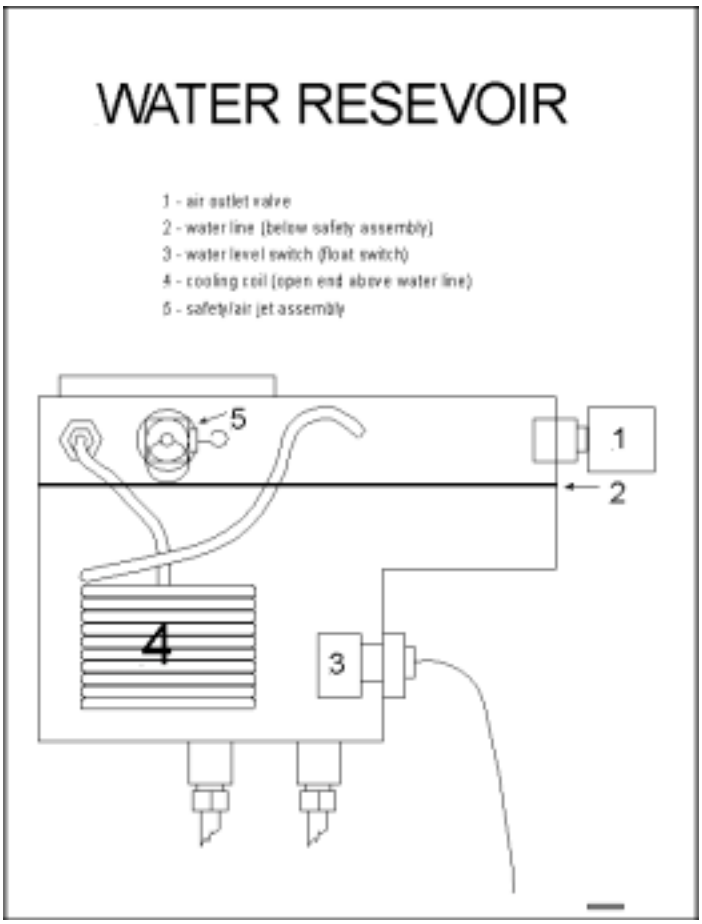
20. If the instruments exhibit a discoloration this can be due to the mixing of carbon steel and stainless steel. When these two metals come into contact with each other an electrolysis occurs that breaks down the metal. The best solution is to separately wrap the carbon steel to insulate it from other 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 then 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 250^0F and 274^0F (121^0C and 134^0C).

This program comes set with these default parameters:

Sterilization temperature	273^0F
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 250^0F and 274^0F (121^0C and 134^0C).

***** Caution – in no case should the temperature be set higher than 274^0F (134^0C) *****

Any change of temperature must be coordinated with a corresponding change is 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 then 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 250^0F and 274^0F (121^0C and 134^0C)
This program comes set with these default parameters:

Sterilization temperature	273^0F
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 250^0F and 274^0F (121^0C and 134^0C).

***** Caution – in no case should the temperature be set higher than 274^0F (134^0C) *****

Any change of temperature must be coordinated with a corresponding change is 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 then 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

This program is for sterilizing liquids solutions, distilled water, medicines and other liquid preparations. For proper liquid sterilization it is recommended that only the default parameters be used.

This program comes set with these default parameters:

Sterilization temperature	250^0F
Sterilization time	30 minutes
Dry time	drying is not allowed

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 then 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 then 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 which is located at the bottom of the Front Console Panel

If a Printer is installed then 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 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 over tighten 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 out through out 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 work load.

5.5 Standard Sterilization Temperatures & Times for a Steam Sterilizer

Type of Load	Temperature	Pressure	Time
Unwrapped	273 F (134 C)	30 psi	3 min
Items	250 F (121 C)	15 psi	15 min
Lightly Wrapped	273 F (134 C)	30 psi	7 min
(Bagged or Paper towel wrapped)	250 F (121 C)	15 psi	20 min
Heavily Wrapped	273 F (134 C)	30 psi	10 min
(Double bagged or Cloth wrapped)	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

It is required that the Chamber and internal plumbing of your Tuttnauer Autoclave 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 9.15)

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

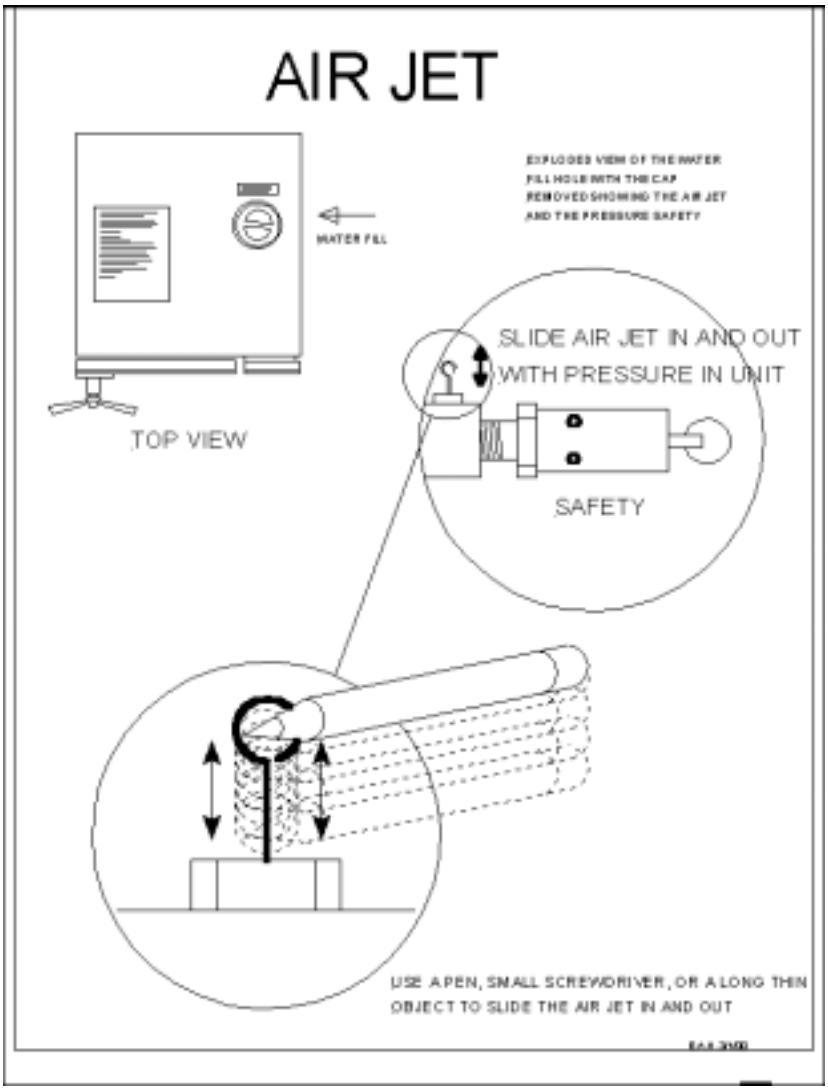
It is required that the Air Jet, which is located just inside the Water Reservoir, be cleaned once per week or more often if necessary to remove any accumulated dirt and debris.

Remove the Water Reservoir cover

With an object similar to a pen or screw driver 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.

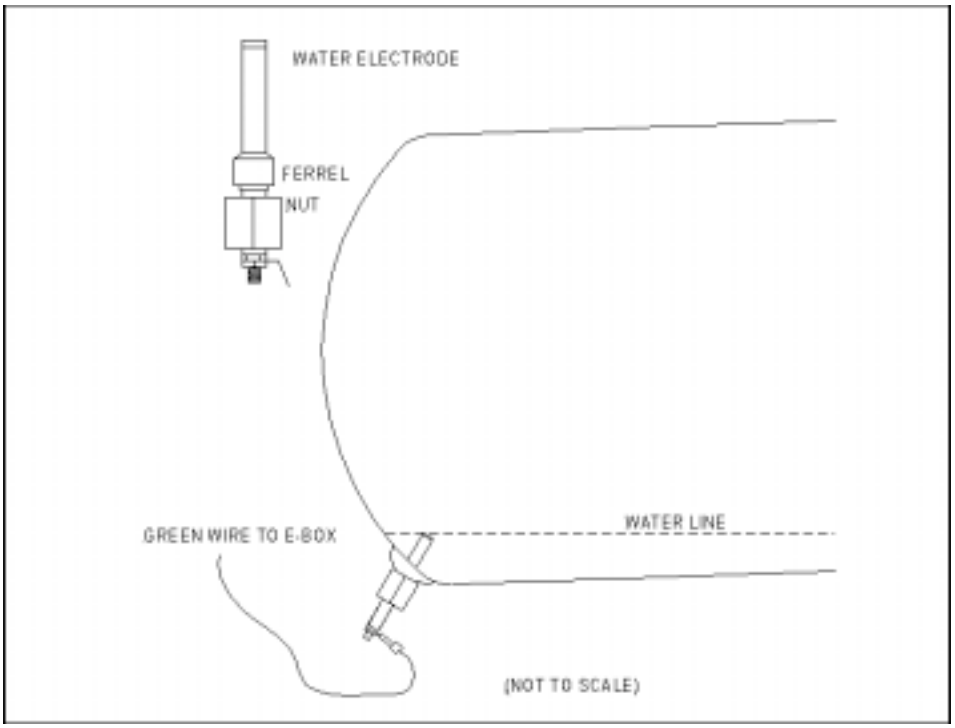


6.1.3 Cleaning the Water Sensing Electrode

It is required that the Water Sensing Electrode 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.



6.1.4 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

It is required by the ASME (American Society of Mechanical Engineers) for safety reasons, that the Safety Valve, which is located just inside the Water Reservoir, be cleaned every two (2) months 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.

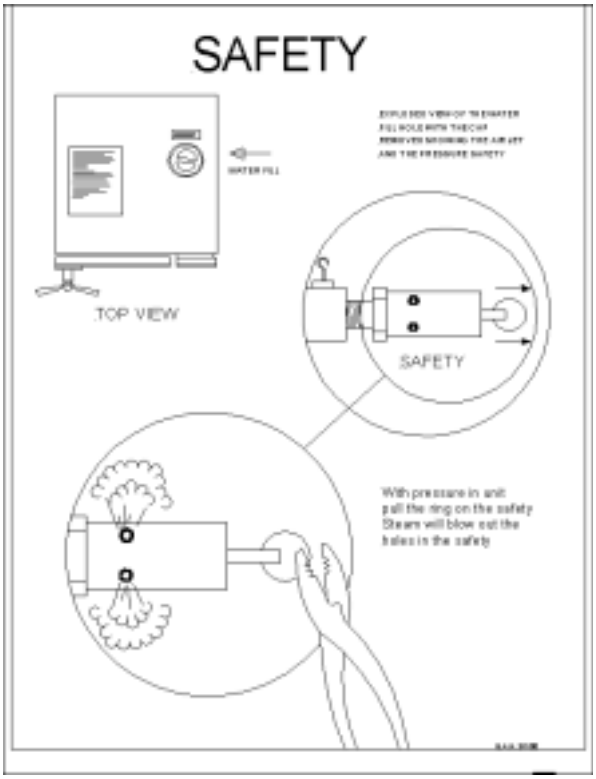
Remove the Water Reservoir Cover.

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

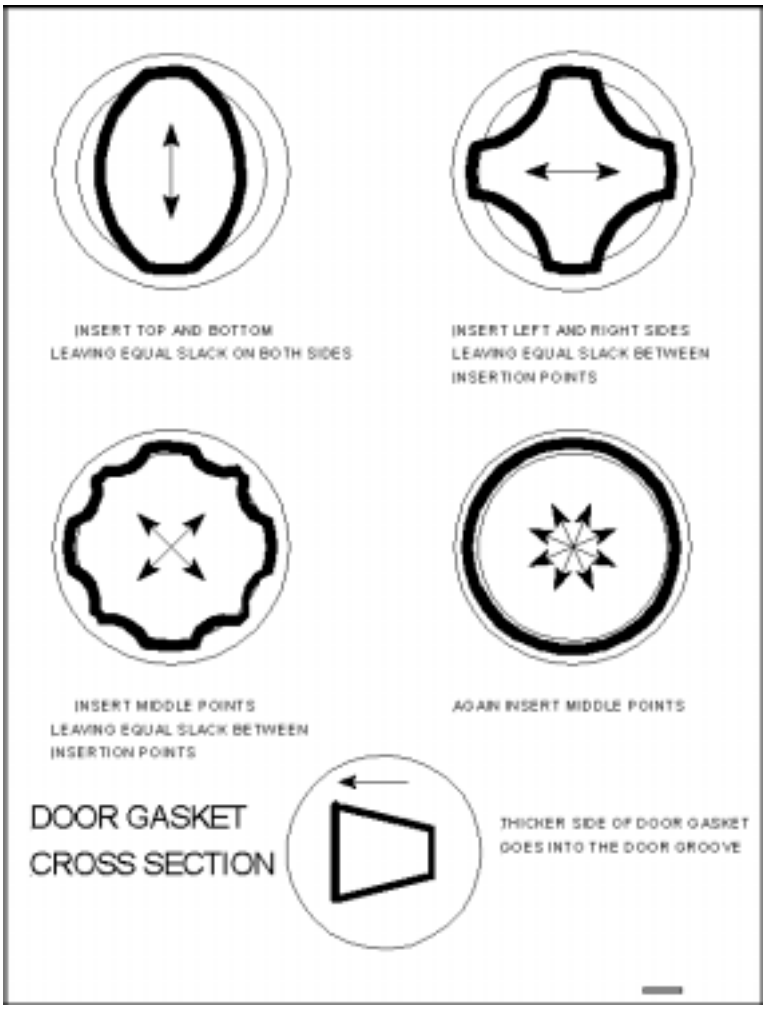
6.2 Door Assembly Maintenance

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

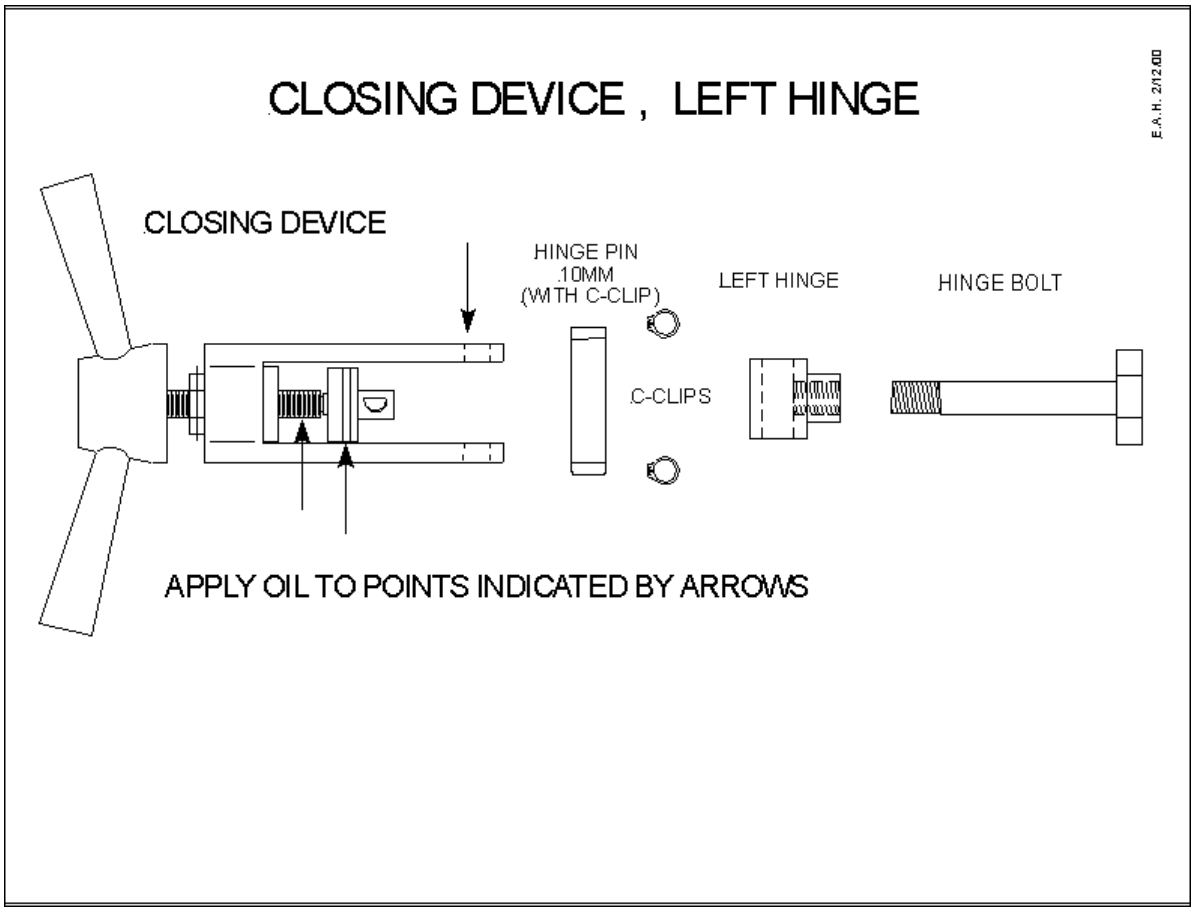
Put two drops of multipurpose oil on the threaded shaft of the Closing Device. Place these drops as close to the Bridge as possible

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



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.
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 is a Filter Screen.
Before removing the cap make sure the Chamber and Reservoir are empty of any water.
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 was a plastic screen in the fill hole inside the Chamber

6.4.2 Valve Cleaning

If cleaning the Fill Valve make sure the Reservoir and Chamber are empty of any water.
If cleaning the Exhaust Valve make sure the Chamber is empty of any water.
If cleaning the Dry Pump Valve make sure the Chamber is empty of any water
Remove the electrical coil by using a ¾ inch wrench to loosen the retaining nut
Remove the Plunger Assembly using a 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, 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 show any signs of rust then 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 then 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

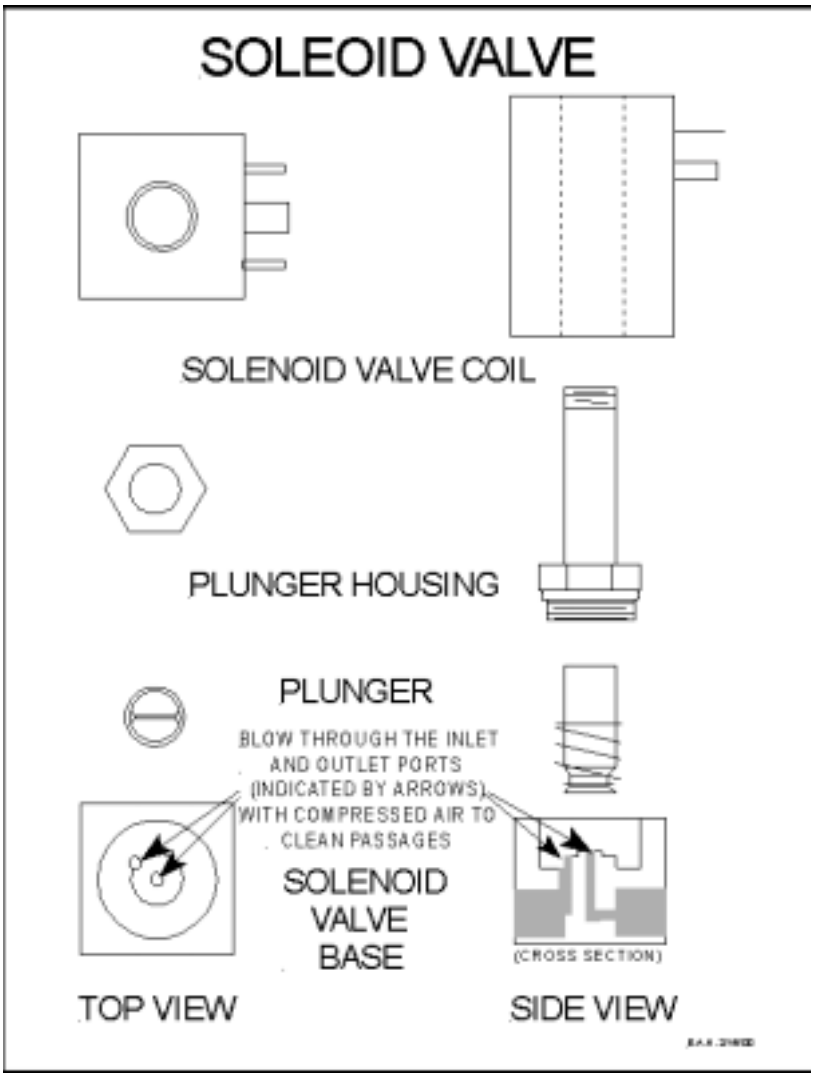
Using compressed air blow out both the incoming and outgoing passage ways in the base

Inspect the valve base for damage.

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

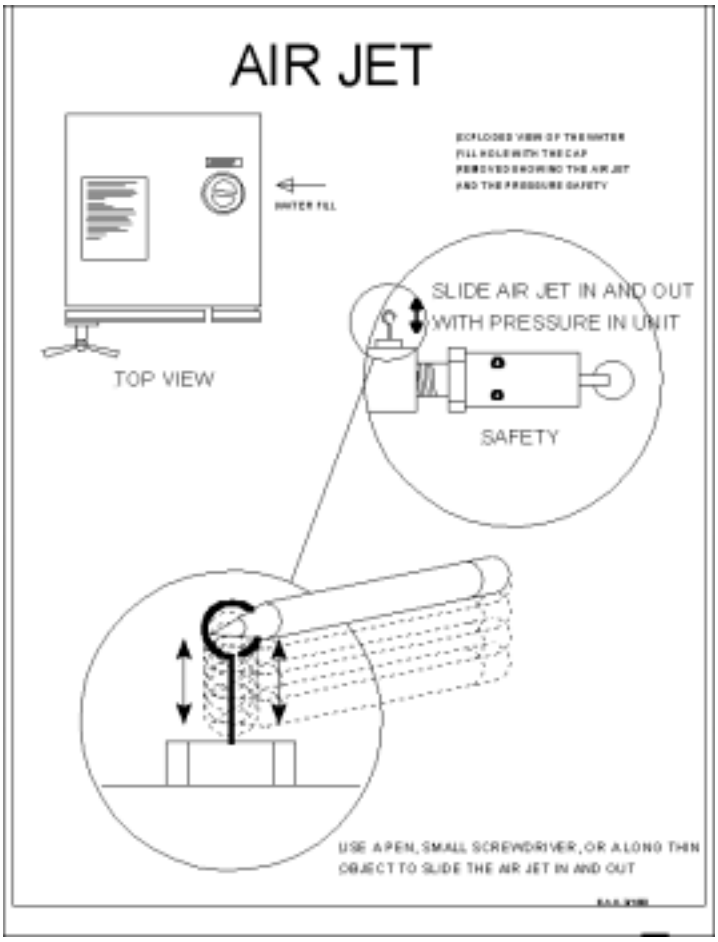
A dirty Air Jet is the number one cause of failed spore tests

It is required that the Air Jet, which is located just inside the Water Reservoir, 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 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 screw driver 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.

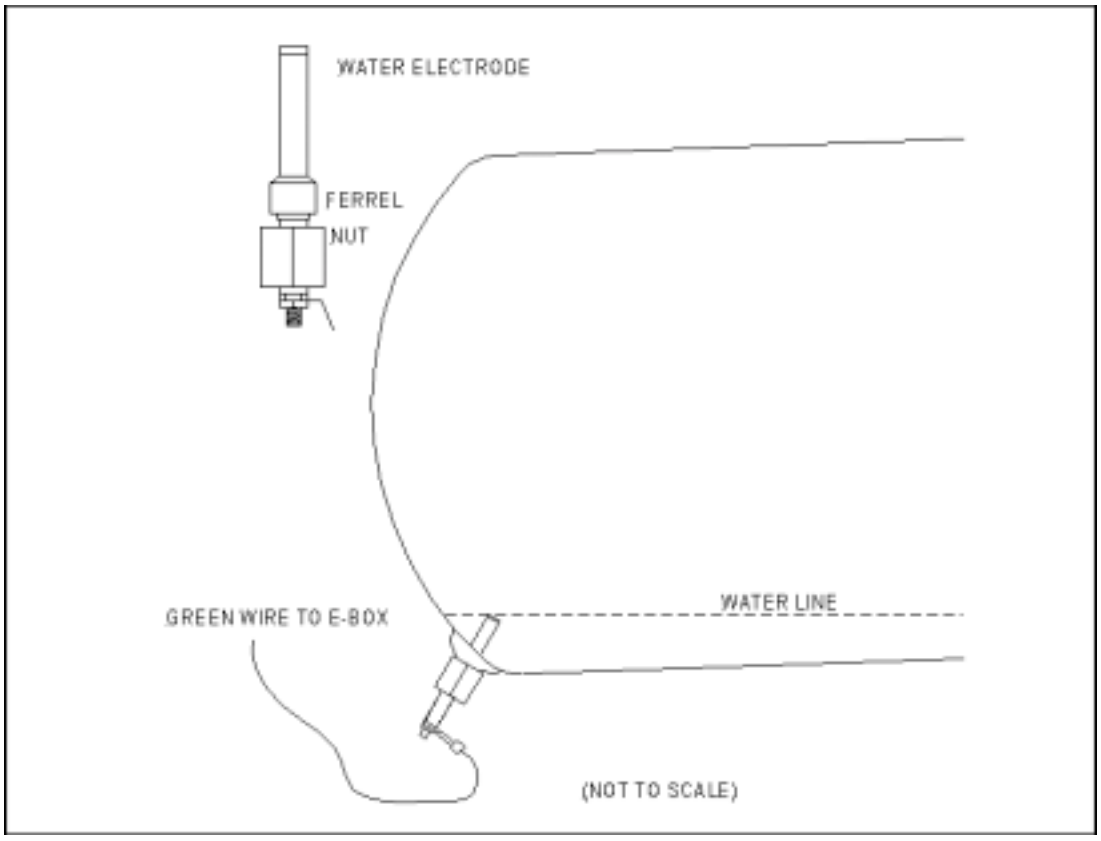


6.6 Water Sensing Electrode

It is required that the Water Sensing Electrode 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 <u>sides</u> of the electrode as well as the tip, to remove any dirt and debris that may have built up.



6.7 Chamber Maintenance

It is required that the Chamber and internal plumbing of your Tuttnauer Autoclave 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 9.15)

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.

Note: A new cover will come with each new Air Filter

6.9 Safety Relief Valve Maintenance

It is required by the ASME that the Safety Valve, which is located just inside the Water Reservoir, be cleaned every two (2) months to remove accumulated dirt and debris. (see drawing below), failure to do this can result in a suspension of the owner liability insurance.

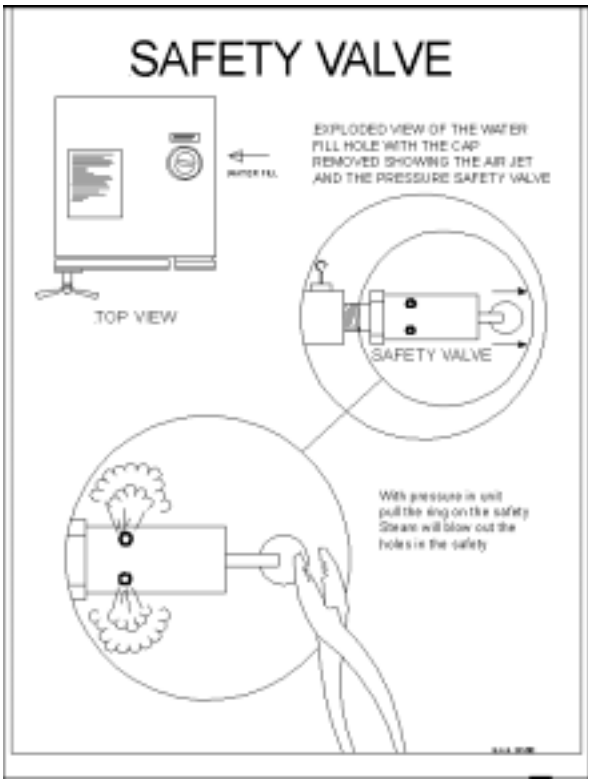
Accumulations of dirt will cause the valve to leak resulting in the inability of the autoclave to maintain pressure.

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.

CAUTON - This next step will expose you to HOT STEAM

CAUTON - 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.

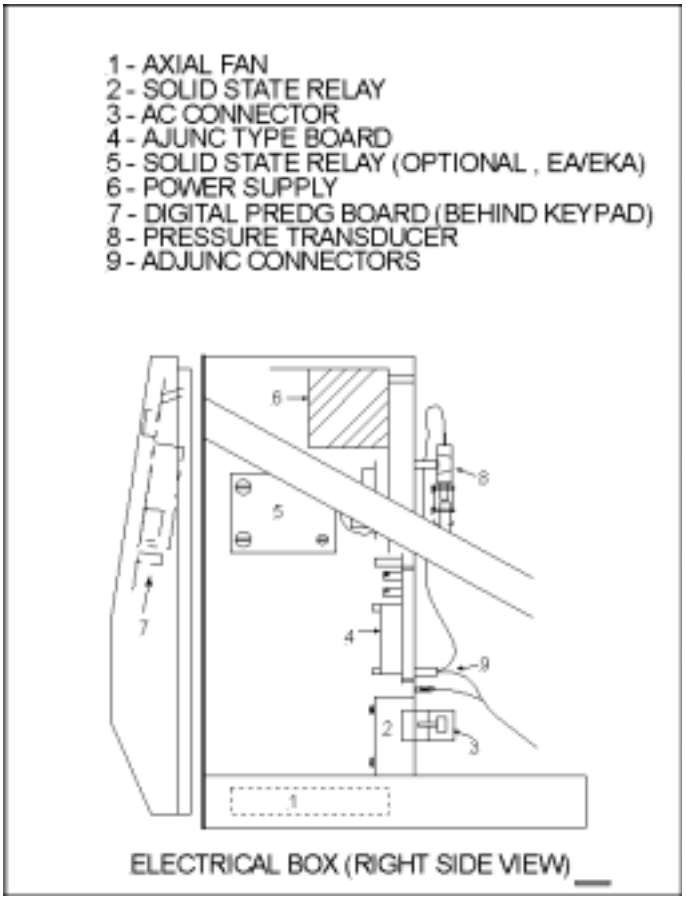


6.10 Printed Circuit Board Maintenance

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 build up 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 is a brass disk with three Allen screws (3mm)
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.

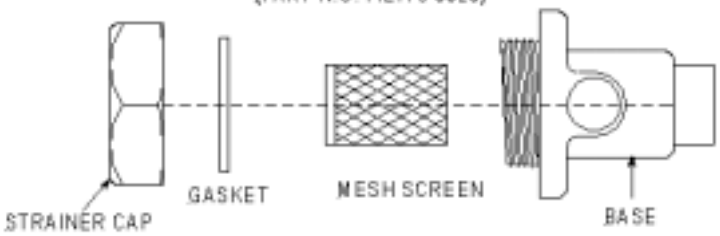
6.11.3 Plastic Chamber Screen

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

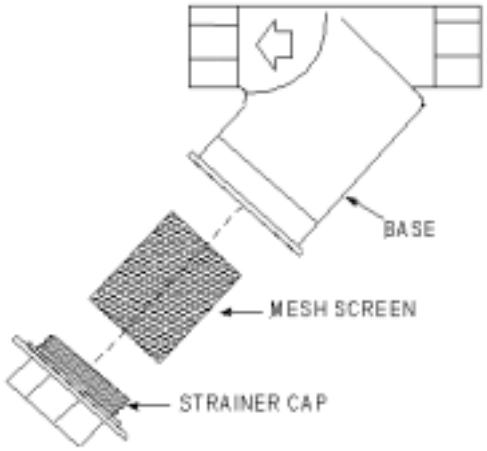
6.11.4 Chamber Strainer

Units 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.**
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 then open and clean the strainer.
Replace the screen and tighten down the cap

CHAMBER STRAINER
(PART N.O. FIL175-0020)

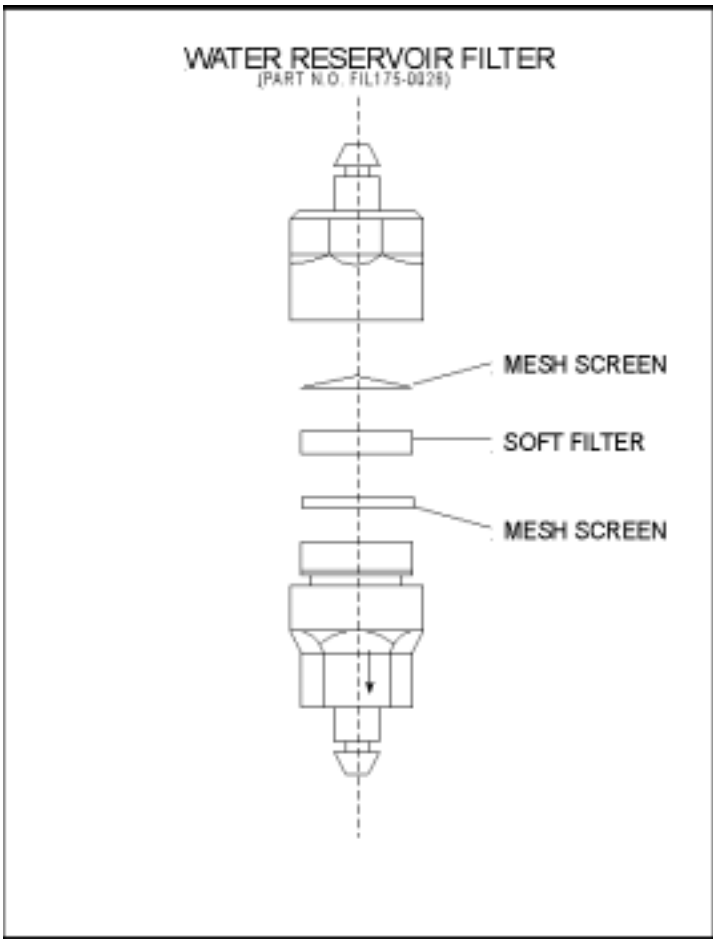


CHAMBER Y-STRAINER
(PART N.O. FIL175-0005)



6.11.5 Pump Strainer

Units with Microprocessors that have a date code 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 on to the strainer.



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 then unplug the unit and try the Circuit Breaker again. If it refuses to stay on when unplugged then change it. If it stays on only with the unit unplugged then, continue checking the systems in order to discover the location of the short circuit. Other wise see the section on Circuit Breakers [sec 7.8]

Check the condition of the Fuses and Fuse Holder with an Ohm Meter (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. (the Cut-Out Thermostat may need to be reset using the point of a pencil or pen to push the button all the way in).

If the Cut-Out Thermostat will not reset then 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.

The proper range for 220 volt machines is between 220 and 235 volts.

Check for a damaged line cord.

Remove the cover -- using 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 then see the section on circuit breakers and fuses [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 then reset the Cut-Out Thermostat.

If the Chamber has cooled and the Cut-Out Thermostat cannot be reset then replace it. [see sec 10.2]

If continuity is present then reinstall both wires on the Cut-Out Thermostat

If the unit still does not turn on then 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 then check across pins 1 and 5 for the line voltage. [see sec 9.9]

If voltage is not present then recheck from "Remove the cover" above. Looking for a loose wire connector or broken wire.
If voltage is present then 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 9.10]

Voltage should be continuous from the Molex connector **to** the On/Off switch, **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 then 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 then replace the power supply. [see sec 10.5]

If the line voltage is present on the input side of the Power Supply then 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 then see the section on the Power Supply [sec 7.19].

If there is output power from the Power Supply but the unit will not come on then 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. Then turn the unit back on.

DO NOT PLUG OR UNPLUG CABLES WITH THE UNIT TURNED ON

If the unit turns on, then 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 then that cable should be left off until the procedure is finished and then 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 then 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 wall outlet

The proper voltage range for 110 volt machines is between 110 and 125.

The proper 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 is has been activated; if so then see the section on the Cut-Out Thermostat [sec 7.26]

Check if the Circuit Breaker or Fuses are being tripped, if so then see the section on the Circuit Breaker and Fuse problems [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 9.9

If all the connections appear good then 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 build up on the circuit boards and fan, (turn the unit off and blow out the electronic box with compressed air).

If the problem persists then 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, then cooling them down should temporarily relieve the problem. Which ever 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.
The proper range for 220 volt machines is between 220 and 235 volts.

Remove cover --

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& 2 of the Heat SSR. Check for an open between terminals 1 & 2 with an ohm meter. Be sure to reverse the meter leads and check in the opposite direction also. Repeat the procedure for terminals 3 & 4. If an open is found then replace the Heat SSR. [see sec 10.8]

Reconnect the wires to the Heat SSR, then 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 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 proper voltage or cycling properly then:
While the unit is running check the control signal between TP12 to TP1 on the Ajunc board. With a volt meter 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 then there is a Control Problem [see sec 7.20]

If the control signal is correct at the test point then 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]
For units with control proms earlier T93N3 check that the 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 and 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 273F (134C) [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 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 Heat SSR then 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 then there is a Control Problem [see sec 7.20]

If the control signal is correct at the test point then 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. 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 close [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 build up of pressure.
The proper voltage range for 110 volt machines is between 110 and 125.
The proper 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 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 cover --

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 and
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 then:
Check for any loose or broken wires
Check the 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.

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 and disconnect and then 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 ^{0}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 and disconnect and then 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 reading are correct by using a mechanical pressure gauge and an independent thermometer. [see sec 8.11]
If the displayed pressure is not accurate then recalibrate the Pressure Sensor [see sec 8.5]
If the displayed temperature is not accurate then 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 4psi 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 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. 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 10psi above the pressure required for sterilization the cycle will abort.

Possible causes:

1. Sterilization temperature has been set above 273 ^{0}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 calibration is incorrect
   Turn off the power and disconnect and then 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 reading are correct by using a mechanical pressure gauge and an independent thermometer.
   If the displayed pressure is not accurate then recalibrate the Pressure Sensor [see sec 8.5]
   If the displayed temperature is not accurate then 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
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. 273F = 30psi) then check Pressure Problems in sec 7.3
If the unit **can** maintain the proper pressure then 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 273F (134C) [see sec 5.3]
Check if the Heating Elements are staying on continuously, if so then see Heat up problems 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 and disconnect and then 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 reading are correct by using a mechanical pressure gage and an independent thermometer. [see sec 8.11]
If the displayed pressure is not accurate then recalibrate the Pressure Sensor [see sec 8.5]
If the displayed temperature is not accurate then 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 36F that indicates a bad sensor, replace the Temperature Sensor [see sec 10.3] and recalibrate
Check for a loose connection. Turn off the power and disconnect and then 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 Ajunc2 Board

then replace the LM34 Temperature Sensor [see sec 10.3] and recalibrate
If this is not successful then replace the Digital Predg Board [see sec 10.19] and recalibrate

If the sensor will not calibrate properly and the unit has an Ajunc3 Board then replace the Ajunc3 board. [see sec 10.18] and recalibrate
If this is not successful then 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 4.5^0F 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. 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 9^0F above the required sterilization temperature the cycle will be aborted.

This message can **ALSO** indicate a bad Temperature Sensor – the message will display any time during the heat up phase. If this happens then 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 calibration is incorrect
   Turn off the power and disconnect and then 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.
   Use a mechanical pressure gauge to verify and recalibrate the pressure [see sec 8.5]
   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 then 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 and disconnect the small flat cable going from the Keypad to the Digital Predg Board, inspect the connector for bent pins and then reconnect making sure the connection is solid
Turn off the power and disconnect and then reconnect the flat cable going from the and 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 then 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 to high [see sec 5.3]

The sterilization temperature is set to 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 to 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 Safety Thermostat and / or Cut-Out Thermostat are not functioning properly. The probes maybe loose or miss positioned or the tubes maybe 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.

The proper 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 Safety Thermostat and / or Cut-Out Thermostat are not functioning properly. The probes maybe loose or mispositioned or the tubes maybe kinked. [see sec 7.7, sec 7.26]

7.7 Safety Thermostat Problems

7.7.1 There is no continuity across the Safety Thermostat

To correctly check continuity unplug the unit and remove the two power wires from the Safety Thermostat, use an ohmmeter to check across the terminals for continuity

Make sure the Chamber has cooled. If the Chamber remains hot the Safety Thermostat will not automatically reset.

If the Safety Thermostat will not automatically reset and restore continuity across it's terminals then replace the Safety Thermostat [see sec 10.2]

7.7.2 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 Safety Thermostat is hard wired (as on units with control proms earlier than T93N3) then replace the Safety Thermostat. [see sec 10.2]

If the 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 Safety Thermostat to the microprocessor. The unit should immediately turn off power to the Heating Elements. If this does **not** happen then 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) then replace the 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 but a problem with the Power Supply fuse then see sec 7.19 or if the problem is with the Dry Pump Fuse, see sec 7.9

Check for correct voltage at wall outlet

The proper voltage range for 110 volt machines is between 110 and 125.

The proper range for 220 volt machines is between 220 and 235 volts.

Check for 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 then, 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 then check that the Circuit Breaker is in the on position

If the unit has a Circuit Breaker and all the above are okay then replace the Circuit Breaker

7.8.2 The circuit breaker or fuse gets hot

If this is not a main fuse problem but a problem with the Power Supply fuse then see sec 7.19 or if the problem is with the Dry Pump Fuse, see sec 7.9

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.

The proper 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

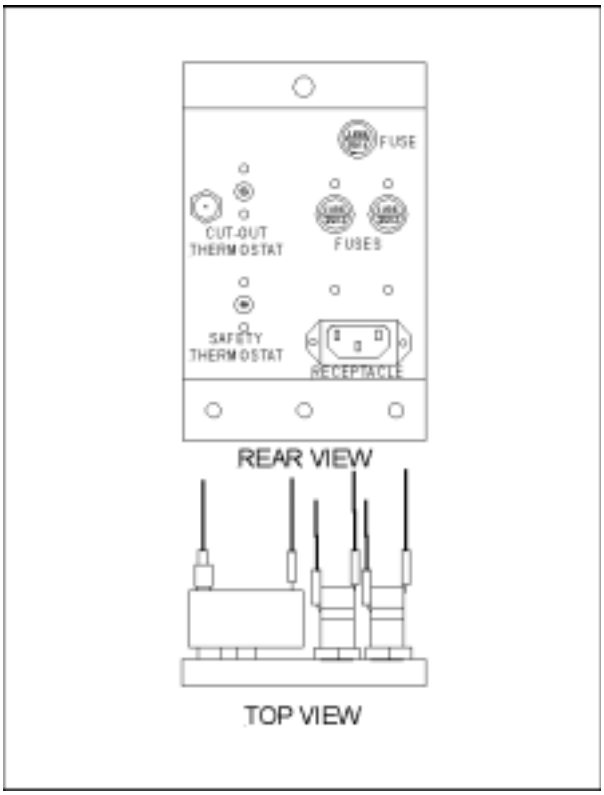
Check for loose wire connections on the input and output side of the Circuit Breaker or Fuse. Loose connectors will cause arcing that will cause that device to get hot.

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 then check the resistance of the Heating Elements of particular interest would be a reading to ground. [see sec 8.2]

If the unit has fuses then check for loose internal connections on the Fuse Holder

If the unit has a Circuit Breaker and all the above are okay then 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 but a problem with the Power Supply fuse then see sec 7.19 or if the problem is with the Dry Pump Fuse, see sec 7.9

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.

The proper 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 9.9)

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

If this is not a main fuse problem but a problem with the Power Supply fuse then see sec 7.19 or if the problem is with the Dry Pump Fuse, see sec 7.9

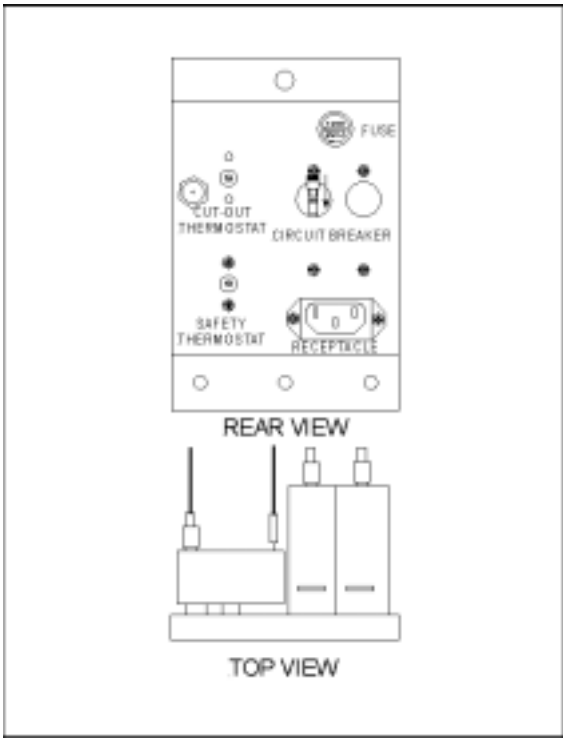
Check that the voltage is in the correct range for that unit.

The proper voltage range for 110 volt machines is between 110 and 125.

The proper 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 9.9)



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 but a problem with the Power Supply fuse then see sec 7.19 or if the problem is with the Dry Pump Fuse, see sec 7.9

Make sure this problem occurs when the units 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 then replace Fuse Holder or Circuit Breaker

If the problem goes away then

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 9.9)

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 you need to press the Stop Button and abort the present Dry Cycle then select the Dry Only cycle make sure the amount of dry time is correct and make sure the door is closed then 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 ohm meter, 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 of the Dry SSR (Solid State Relay). The Dry SSR is located inside the Electronic Box . Terminals 3 and 4 are connected to JP16 on the Ajunc 3 board and JP9 on the Ajunc 2 board. Connect these two wires together and turn the power back on. If the pump runs then 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 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 then check if the signal is at the Dry SSR. A reading across terminals 3 and 4 should show 10 to12 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 then 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 then check if the signal is at the Dry SSR. A reading across terminals 3 and 4 should show 10 to12 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 then 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 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 Dry SSR and it should be replaced. If the fuse does not blow then 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 Dry Pump mounting bracket is loose or broken, if bad replace the pump bracket

7.9.5 Pump does not pump air

Is the HEPA Filter clogged?

Remove the HEPA Filter and run the dry cycle. If air is now being pumped then install a new HEPA Filter

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 then the solenoid has been turn on. If no magnetic field is detected then [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 then [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 then the problem is with the Plunger.

If not then remove the housing. If air is pushing through to the valve base then the problem is in the tubing from the valve base to the Chamber.

If the air is not pushing through to the valve base then the problem is with the tubing from the base to the pump or the Dry Pump itself.

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

Drying is available only in the **Wrapped** and **Unwrapped Cycles**
Liquid Cycles have no rapid exhaust or drying capacity
Drying time may be to 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 should be approximately 30 minutes.
For **EA, EKA, EZ** and **EZ10k** machines with a full load a typical dry time would be approximately 20 minutes. On these models the door does not need to 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:

Model	1730	3 lbs
	2340	7 lbs
	2540	9 lbs
	3870	18 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 be stood 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 then 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 to 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.
The proper range for 220 volt machines is between 220 and 235 volts.
The Safety Thermostat may be interrupting power during the drying cycle [see sec 7.7]

The Air Outlet Valve maybe clogged or not opening properly which will not allow the Chamber to vent properly [see sec 6.4, sec 7.17]

The Exhaust Valve maybe clogged or not opening properly which 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 which 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 over filled allowing water to siphon back into the Chamber during Dry

There may be a pin hole in the body of the Cooling Coil allowing water to siphon back into the Chamber. This will only be true for E and EK machines

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. This will only be true for E and EK machines and can be easily corrected by reaching into the Reservoir and holding down the body of the coil while pulling up on and stretching the neck.

EA, EKA, EZ and EZ10k machines have a different Cooling Coil and a Check Valve to protect against this situation. If suck back is occurring during the Dry Cycle or normal cool down then 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 Air flow 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.

The proper 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 Safety Thermostat and / or Cut-Out Thermostat are not functioning properly. The probes maybe loose or mispositioned or the tubes maybe kinked. [see sec 7.7, sec 7.26]

7.11 Sterilizing Problem

7.11.1 Spore tests are failing or Indicator strips are not turning

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:

Model 1730	3 lbs
2340	7 lbs
2540	9 lbs
3870	18 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 be stood 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 then 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 two temperatures. The first being 250F(121C) for a period of 15 minutes for unwrapped instruments or 20 minutes for wrapped instruments. The second at 273F(134C) for a period of 3 minutes for unwrapped instruments or 7 minutes for wrapped instruments

The autoclave can sterilize at other temperatures, however the appropriate sterilization time for each intermediate temperature has not been calculated by Tuttnauer. If a temperature between 250F(121C) and 273F(134C) is being used the best procedure is to default to the longest possible sterilization time, in this case it would be 15 minutes for unwrapped instruments and 20 minutes for wrapped instruments. It is not

recommended that a temperature below 250F(121C) be used for sterilization.
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 then continue to the next step.

Checking temperature and pressure

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

1730E, 2340E & EA, 2540E & EA, EZ9 and EZ10 units will take approx. 20 minutes
3870E & EA units will take approx. 35 minutes
All EK, EKA and EZ10k units will take approx. 6 minutes
(these times are approximate and depend on the initial temperature of the Chamber 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. then clean or replace the Air Jet [see sec 6.5]
If the unit is not able to reach the proper pressure then 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 then 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 should start the Fan again. If not then cycle the unit off then on and that will reset the Fan

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 then check that the JP5 connector on the Ajunc 2 Board or the JP15 on the Ajunc 3 Board is plugged in correctly. Unplug and then 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 for +12 volts DC.

If the correct voltage is not present then check across TP15 and TP1 for the +12 volts. If the voltage is not present across TP15 and TP1 then check the Power Supply [see sec 7.19]

If the voltage across TP15 and TP1 is correct then 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, then 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 stays on as long as the autoclave is turned on. Autoclaves manufactured after 2/2000 have no sleep mode.

Check for a good connection at JP10. Unplug and then replug in 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 then check across TP15 and TP1 for the +12 volts. If the voltage is not present across TP15 and TP1 then check the Power Supply [see sec 7.19]

If the voltage across TP15 and TP1 is correct then replace the Ajunc 3 board [see sec 10.18]

If the correct voltage is present across JP10 and the connection is good then 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 laying 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 laying 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 then 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 on to 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 over tighten the door. Over tightening 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 is wispping out by the Closing Device, replace the Door Bellows [see sec 10.11]
Steam is 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 then lubricate the Door Hinge Pin
If lubrication does not help then repair the hinge assembly [see sec 7.14.4]
If the Closing Device is stiff and does not run in and out smoothly then lubricate the threaded shaft.
If lubrication does not help then 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.

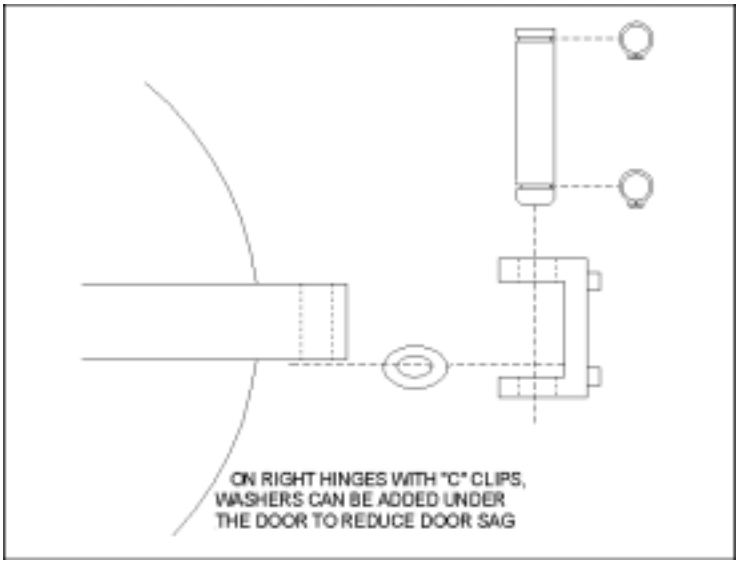
If the Door Hinge is loose allowing the Door to hang down this is most often more an inconvenience than a problem. As long as the hinge pin is not in danger of falling out and the Chamber is being sealed then no action need be taken. To repair this see sec 7.14.4
If the Plastic Door Cover is rubbing on the Cabinet when the Door is opened or closed, first determine which of the four mounting screws is closest to the problem. Then 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 then both screws will need washers. [see also sec 7.14.5]

7.14.4 Door hangs down

For Door assemblies with C-clips on the hinge pin

If the hinge pin is the type with C-clips on top and bottom then remove the pin and examine it for straightness by rolling it along a flat surface
If the pin does not roll smoothly then replace it
If the pin is okay then insert it first into the part of the hinge attached to the machine and then into the part of the hinge on the Door. The pin should move up and down smoothly. It should not be able to rock back and forth.
If the pin does not move smoothly or a rocking is evident then repeat the procedure with another pin. If a new test pin is not available then use the pin from the Closing Device, making sure it is straight by first rolling it on a flat surface.
If a substitute pin is not available then use the following procedure

If the pin is able to rock back and forth then rotate the pin ¼ of a turn and recheck it.
If the looseness disappears then replace the pin
If the looseness remains then 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.



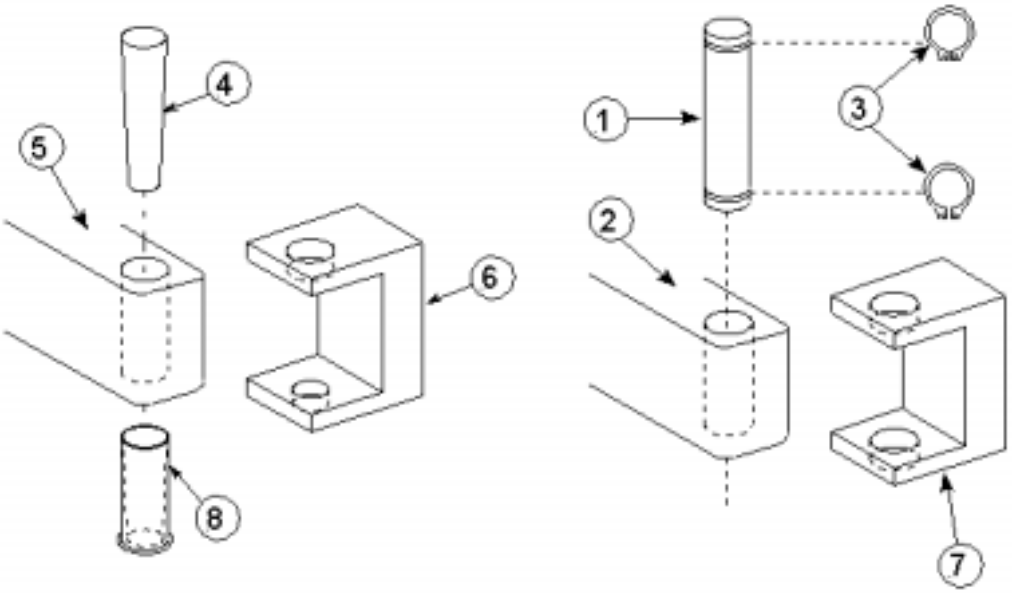
Caution ***

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.

If the Door hanging is due to a spread that has developed between the stops on the hinge then 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.

RIGHT HINGE COMPONENTS
(1730, 2340 AND 2540 MODELS)



TAPERED (WITHOUT "C" CLIPS) NON-TAPERED (WITH "C" CLIPS)

ITEM	PART NO.	DESCRIPTION
1	CT 224010	HINGE PIN 10mm (MADE FOR USE WITH "C" CLIPS)
2	CU211012 CT211013 CV211014	DOOR (PART N.O. DEPENDS ON MODEL)
3	09501223	HINGE PIN "C" CLIPS
4	CT224030	HINGE PIN 10mm (MADE FOR USE WITH OUT "C" CLIPS)
5	CU240010 CT240010 CV240010	DOOR (PART N.O. DEPENDS ON MODEL)
6	CT232010	RIGHT HINGE (TAPERED) 10mm
7	CT232010-1	RIGHT HINGE (NON-TAPERED O/S) 10mm
8	CT 211050	BRASS DOOR BUSHING 10mm

E.A.H. 2/18/2003

For Door assemblies <u>without</u> C-clips on the hinge pin

The hinge pin without C- clips is more commonly referred to as a tapered pin or pressed pin. This type of assembly has a brass bushing in the door part of the hinge. This bushing is designed to wear out before the pin or hinge itself. And as a result it needs to be replaced from time to time.

Because of ASME (American Society of Mechanical Engineers) regulations the brass bushing can only be repaired at the **Tuttnauer Repair Center.** In order to insure the integrity of the Door assembly there is a specific procedure outlined by ASME that needs to be followed. In addition ASME requires that this procedure be preformed only by an ASME certified shop.

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 then 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.

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 then 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 then 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 then 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 mess screens and one fiber screen. [see sec 6.11]

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 and 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 then, 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 then:

Check TP10 to TP1 on the Ajunc board for a 0 to 1 volt DC signal when the button is pushed and a 10 to12 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 then check at the solenoid itself for the proper voltages. [see sec 8.3]

If the solenoid is not receiving the correct voltages then check the wiring between the connection box and the back of the Ajunc board for a bad connection.

Repair the connection.

If the previous connection is good then replace the Ajunc board.

If the correct voltages are observed then 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, then water should be flowing on units manufactured up to 2/2000.

If the unit has a Microprocessor dated T97DN7WP or later then 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 then see the beginning of this section **“If no water is flowing then 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 then:

Check TP10 to TP1 on the Ajunc board for a 0 to 1 volt DC signal when the button is pushed and a 10 to12 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 then check at the solenoid itself for the proper voltages. [see sec 8.3]

If the solenoid is not receiving the correct voltages then check the wiring between the connection box and the back of the Ajunc board for a bad connection.

Repair the connection.

If the previous connection is good then replace the Ajunc board.

If the correct voltages **are** observed then 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, then water should be flowing on units manufactured up to 2/2000.

If the unit has a Microprocessor dated T97DN7WP or later then 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 not then 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 then 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 mess screens and one fiber screen. [see sec 6.11]

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 and 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 then reset the automatic fill. [see sec 8.6]

If the unit was manufactured before 2/2000 then 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. Then the voltage will read between 3.5 and 5 volts.

If the voltage changes, before the water has reached the top of the sensor then the sensor has a short and should be replaced [see sec 10.10]

If the Water Sensor checks out okay then reset the automatic fill, following the procedure outlined in sec. 8.6

If it can not fill in the right amount of time then 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 then 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 mess screens and one fiber screen. [see sec 6.11]

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 and 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 then check the Water Sensor [see sec 8.7]
If the water does not stop flowing, then turn off power to the machine.
If water continues to flow and the unit was manufactured before 2/2000 then 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, then 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 then 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 are not seen this would indicate a control problem. [see sec 7.20]
If the correct voltages are observed on the test points then 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 then 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 then 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^{0} 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 over filled. The Reservoir should never be filled while the unit is sterilizing. It should only be filled as high as the base 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 half way use a small screwdriver to press the Outer O-Ring back into the groove in the Drain Valve Base. Then continue screwing in the valve.

7.16.3 Water leaking back into the Chamber

The Reservoir may be over filled

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 then just 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 **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 then 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 then check between TP10 and TP1 to tell if the Fill Valve is being told to open or close. A reading of 0 to1 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 wispping 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 sterile cycle if the pressure rises above 34 psi

Check that the temperature setting is not set any higher then 273F (134C) [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 then 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 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 suppose to be open or 3.5 to 5 volts if the valve should be closed. If TP14 shows an incorrect signal then 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]

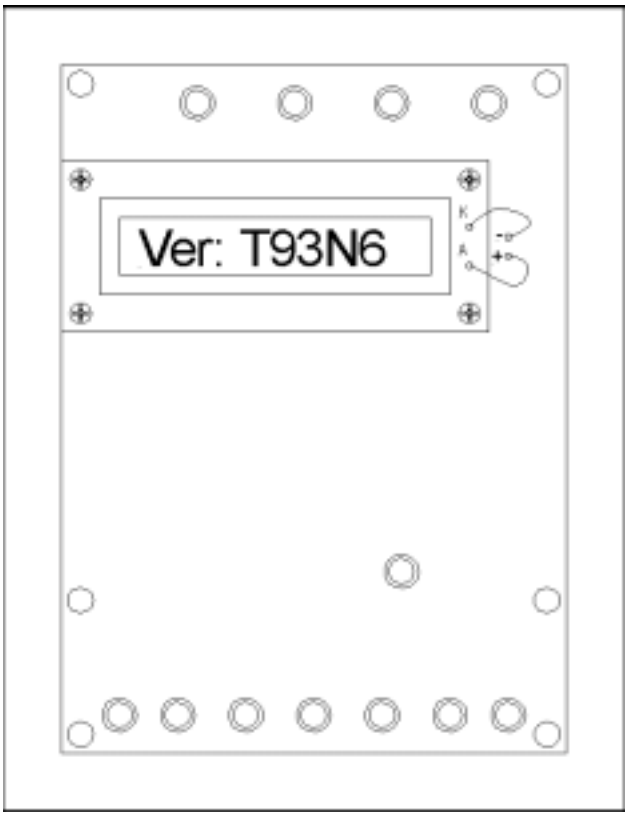
Remove the connection box from the Solenoid Coil and check that the connectors are in place and making good contact with the terminals on the Solenoid Coil. [see sec 8.3]

7.18 Display Problem

7.18.1 Display back light is very faint

Check between TP17 and TP1 for +5 volts DC. If 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 solider to 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 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 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 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 <u>input</u> side

Be sure to turn the power off when connecting or disconnecting wires during trouble shooting of the power supply

Is the unit plugged in?

Is the proper voltage coming out of the wall outlet?

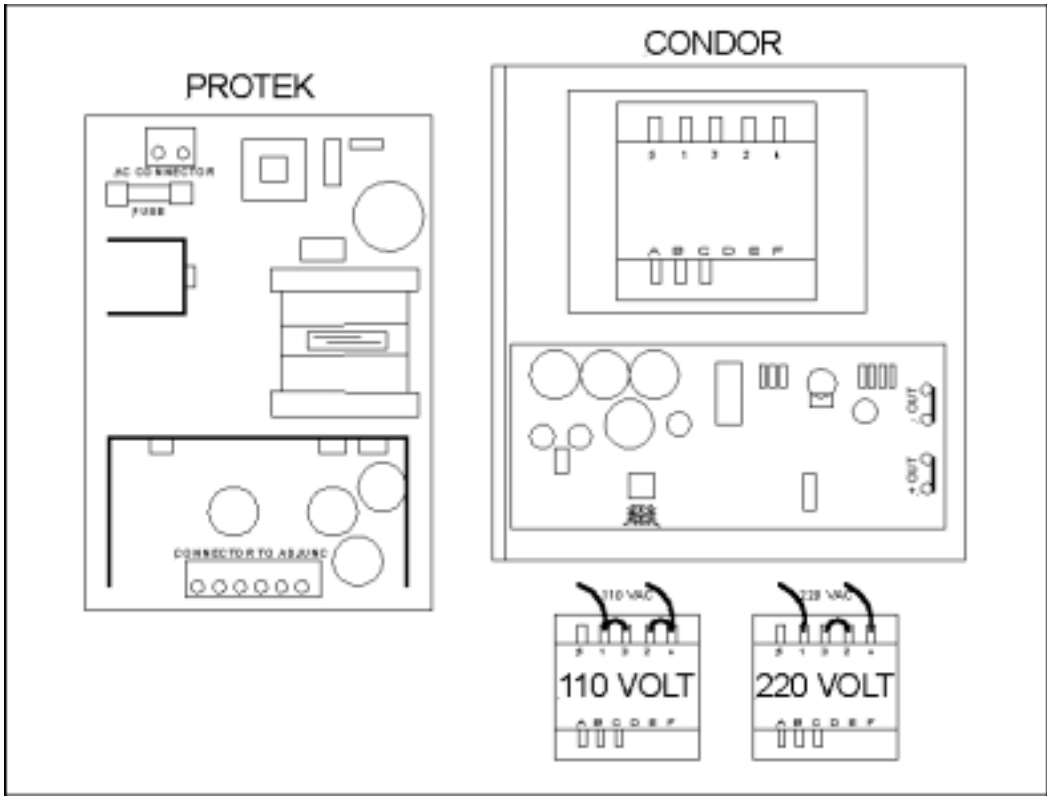
Whether this is a **Condor** or a **Protek** Power Supply when set up for 110 volt operation the Power Supply should have an input voltage between 110 and 125 volts AC.

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 then:

Turn the power off and remove **INPUT** wires from Power Supply turn the power back on and check for the correct input voltage

If line voltage is present on the input wires only when the wires are disconnected then replace Power Supply

If line voltage is still not present with the wires disconnected, then:

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 can not be seen then see the section on Safety Thermostat Problems sec 7.7

Check that the line voltage appears across the output side of the Circuit Breaker or Fuses. If it can not be seen then check the section on Circuit Breaker and Fuse Problems sec 7.8

Check 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 trouble shooting of the power supply

Check the input side of the Power Supply

If there is no input power then see sec 7.19.1

If there is input power then:

Disconnect the Power Supply output wires going to 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 then 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 then change the Power Supply

If voltages are present then disconnect **ALL** other wires connected to Ajunc Board including the Digital Predg board and Printer if one is present Then reconnect the Power Supply output wires.

If the output voltages disappear again, including the +5 volts on units with a **Condor** Power Supply, then 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, then 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 then 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 trouble shooting of the power supply

Make sure the boards in the Electronic Box are free of any dust build up

Check for proper voltage on the input of the Power Supply - if voltages are to low or to 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 then 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 ohm meter 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 preformed 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, then 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 data bus a problem with the printer can cause problems else where 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 Ajunc2 board)
Temperature Sensor (if the unit has an Ajunc3 board and the calibration procedure was successful)
Pressure Sensor (if the calibration procedure was successful)
Add Water Sensor and the reading at TP8 is **correct**
Air Outlet Valve and the reading at TP14 is **incorrect**
Dry Pump and the reading at TP20 for Ajunc3 (TP18 for Ajunc2) 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:

Fan Control on units with Microprocessors
dated T97DN7WP or later
Temperature Sensor can not be calibrated
Pressure Sensor can not be calibrated
Add Water Sensor 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 Ajunc3
(TP18 for Ajunc2) 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 is not scraps or paper stuck in the printer head.
Turn the unit off and 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 then 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 then replace the Printer
If the Printer does print a test pattern, but will not print data then 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 and unplug and replug in 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 then replace the Printer
If the Printer does print a test pattern, but will not print data correctly then 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 then 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 Indicator is always on

Check that the Float Switch is free to move up and down
Check the connector at JP2 on the Ajunc board for 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 acceptable and 3.5 to 5 volts if the level is too low.
If the readings are correct but the indicator light remains on all the time then 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 then replace the Digital Predg board. [see sec 10.19]
If the readings are not correct then check continuity across the Float Switch. Cut the wires going to the Float Switch if necessary, connect an ohm meter 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 then replace the
Float Switch [see sec 10.16]
If the Float Switch checks out okay then there is
a Control Problem [see sec 7.20]

7.22.2 Indicator is always off

Check that the Float Switch is free to move up and down
Check the connector at JP2 on the Ajunc board for loose 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 acceptable and 3.5 to 5 volts if the level is too low.
If the readings are correct but the indicator light remains off all the time then 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 then replace the Digital Predg board. [see sec 10.19]

If the readings are not correct then check continuity across the Float Switch. Cut the wires going to the Float Switch if necessary, connect an ohm meter 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 then replace the Float Switch [see sec 10.16]
If the Float Switch checks out okay then there is a Control Problem [see sec 7.20]

7.22.3 Indicator operates in reverse

Check that the Float Switch is free to move up and down

Check the connector at JP2 on the Ajunc board for 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 acceptable and 3.5 to 5 volts if the level is too low.

If the readings are correct but the indicator light is still opposite of the Float Switch then 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 then replace the Digital Predg board. [see sec 10.19]

If the readings are reversed then 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 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 volt meter. 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 then 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 then replace the Digital Predg board. [see sec 10.19]

If the readings are not correct then remove the green wire attached to the Door Switch and check continuity across the Door Switch normally open contact with an ohm meter.

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 then replace the Door Switch

If the Door Switch is okay then there is a Control Problem [see sec 7.20]

7.23.2 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, then the problem is either:

The Door Switch Activator is misadjusted or missing

or

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 loose connection or a broken wire.

Check between TP9 and TP1 with a DC volt meter. 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 then 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 then replace the Digital Predg board. [see sec 10.19]
If the readings are not correct then remove the green wire attached to the Door Switch and check continuity across the Door Switch normally open contact with an ohm meter.
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 then replace the Door Switch
If the Door Switch is okay then there is
a Control Problem [see sec 7.20]

7.23.3 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 on 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 volt meter. 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 then 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 then replace the Digital Predg board. replace the Digital Predg board [see sec 10.19]
If the readings are not correct then remove the green wire attached to the Door Switch and check continuity across the Door Switch normally open contact with an ohm meter.
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 then replace the Door Switch
If the Door Switch is okay then 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 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 have been reset – including the **Automatic Water Fill**
The **Automatic Water Fill** should be checked and may need to be reset [see sec 8.6]

7.25 Exhaust Problem

7.25.1 Steam does not exhaust

Pressure inside the Chamber can be relieved 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

Open the Exhaust Valve and check for any debris that may be causing the Plunger to be stuck closed. [see sec 6.4]

Blow compressed air from the Valve Base through tubes going to the Chamber and the Water Reservoir. This will clean out any clogs that may have developed. If the tubing remains clogged then 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]

Reassemble all components previously dissembled. Turn the unit on and start a Dry only cycle.

***** Caution the Heating Elements will come on. *****

During the Dry mode the Exhaust Valve should be open

Check between TP11 and TP1 a DC voltage of 0 to 1 volt tells the valve to open and 10 to 12 volts tells it to close.

If TP11 is between 0 to 1 volt and the valve is closed then check for a loose connector or broken orange or 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]

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 if the Solenoid Coil has received the proper signal [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]

7.25.2 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 then 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]

7.25.3 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 suppose to be open or 10 to12 volts if the valve should be closed.

If TP11 shows an incorrect signal then 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]

7.25.2 Water leaks back at the end of the Exhaust cycle

The Reservoir may be over filled

There may be a pin hole 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. This will result in water flowing back into the Chamber during at the end of the Exhaust Phase. This will only be true for E and EK machines and can be easily corrected by reaching into the Reservoir and holding down the body of the coil while pulling up on and stretching the neck.

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 then replace the Check Valve.

7.26 Cut-Out Thermostat Problems

7.26.1 Red reset button will not reset

Make sure the Chamber has cooled. If the Chamber remains hot the Cut-Out Thermostat can not 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 will not stay in.
If power is not restored to the autoclave then unplug the unit and remove the two power wires going to the Cut-Out Thermostat. Use an ohm meter to check continuity across the terminals
If continuity can not be restored across the terminals of the Cut-Out Thermostat by pushing in the red reset button then 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 273F (134C) [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 ohm meter to check across the terminals for continuity
Make sure the Chamber has cooled. If the Chamber remains hot the Cut-Out Thermostat can not 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 can not be restored across the terminals of the Cut-Out Thermostat by pushing in the red reset button then 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

Units with Microprocessors that have a date code containing the letters **WP** will have a Water Pump installed.

Check the Water Pump Fuse with an ohm meter, if needed replace with a 1.2 amp fuse. The Water 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 Water Pump SSR to the Water Pump. The Water Pump SSR is located in the Electronic Box, terminals 3 and 4 are connected to JP15.

Turn the power off, remove the wires connected to terminals 1 and 2 of the Water Pump SSR (Solid State Relay). Connect these two wires together and turn the power back on. If the pump runs then the problem is with either the Water Pump SSR or the control circuit If the Water Pump does not run the problem is with the pump and it should be replaced. [see sec 10.22]

Check if the Water Pump SSR is being told to turn off. With a DVM read between TP13 and TP1, 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 then check if the signal is at the Water Pump SSR. A reading across terminals 3 and 4 should show 10 to12 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 then 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, 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 then check if the signal is at the Water Pump SSR. A reading across terminals 3 and 4 should show 10 to12 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 then 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 terminals 1 & 2 on the Water Pump SSR. Turn the power back on , if the fuse blows again 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

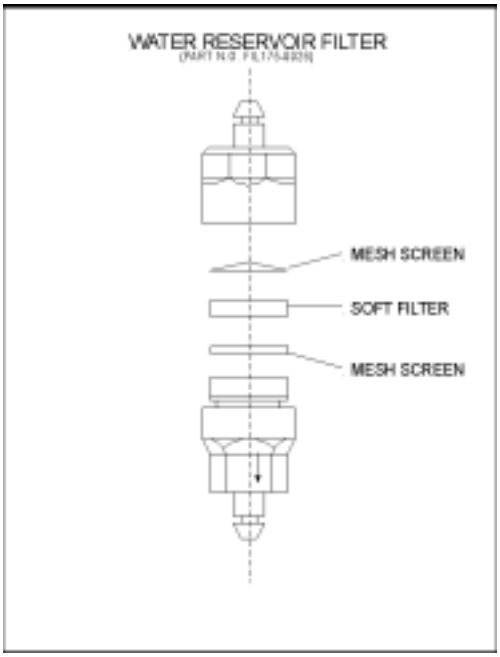
Check if Water Pump mounting bracket is loose or broken

Replace the pump bracket

If the pump bracket is not loose or broken then replace the Water Pump [see sec 10.22]

7.27.5 Pump does not pump water

Is the Pump Strainer clogged?



Clean the Pump Strainer and run the Water Pump using the **Water Inlet Key**. If water is now being pumped then 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 then the solenoid has been turned on.

If no magnetic field is detected
then [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 then [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 then the problem is with the Plunger.

If not then remove the housing. Again press the **Water Inlet Key** if water is pushing through to the valve base then the problem is in the tubing from the valve base to the Chamber.

If the water is not pushing through to the valve base then 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 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 then 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 then replace the SSR. [see sec 10.8]

Replace the wires on the four connector of the SSR
If checking he Heat SSR then 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, no cycle is 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, however this reading should be 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 then check if the Power Supply is properly supplying these voltages
If terminal 4 does not read the correct voltage then, 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 then replace the SSR.
If the reading is correct then 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 then 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 switch **from** between +3.5 and +5 volts **to** between 0 and 1 volt when the Heaters or Dry Pump are **ON** then, check continuity between terminal 4 and the appropriate Ajunc board connector.
If the reading at terminal 4 does not switch **from** between +10.5 and +12 volts **to** between 0 and 1 volt when the Water Pump is **ON** then, check continuity between terminal 4 and the appropriate Ajunc board connector

If continuity is good then there is a Control Problem [see sec 7.20]

If the reading at terminal 4 is between 0 and 1 volt then the SSR is on. The control side of the SSR is okay and the problem maybe on the load side.

For 110 volt units, with the unit on and the device in question 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 then there is a problem with the line voltage wiring going to the SSR.
If terminal 1 shows the same voltage as terminal 2 then replace the SSR.
If there is a voltage reading less than 100 volts across terminals 1 & 2 then replace the SSR.
With the device 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 then 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 then replace the SSR
If the reading across terminals 1 & 2 is greater than 1 or 2 volts then replace the SSR

For 220 volt units, with the device in question in the **OFF** mode a voltage reading from terminal 1 to ground will read approximately 110 volts AC. A reading from terminal 2 to ground will read approximately 110 volts AC. 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 then 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 then 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 then the SSR needs to be replaced. If the voltage is still incorrect then the problem is with the line voltage wiring going to the SSR.

With the device in the **ON** mode a voltage reading from terminal 1 to ground will read approximately 110 volts AC. A reading from terminal 2 to ground will read approximately 110 volts AC. 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 then 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 then 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 then all the elements are good. To determine if the reading is good follow this procedure:

Using the Ohm & Amp Readings Table [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 then 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 then 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 then it can be concluded that the coil has been energized.

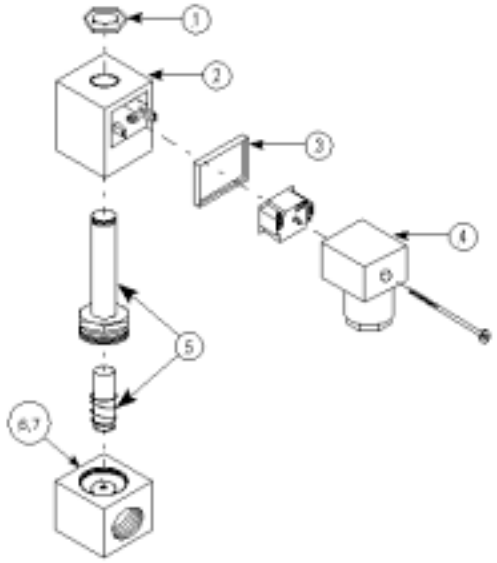
If the valve is operating intermittently or not at all then turn off the autoclave and remove the connection box from the Solenoid Coil. Disassemble the connection box and check that the connectors are solidly in place and making good contact with the terminals on the Solenoid Coil.
While the connection 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 then 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 then check for a control problem. [see sec 7.20]

If the problem clears up when the coil is disconnected then take an ohm reading on the Solenoid Coil. The reading across the two side terminals should be 14 – 15 ohms.
There should be **no** continuity from either of the side terminals to the center terminal.
If a problem is found with the coil then it should be replaced.

Note: For comparison purposes 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	01810909	MAGNETIC SOLENOID NUT
2	01810907 01810102	MAGNETIC SOLENOID 110 VOLTS/8 WATTS(PRE 1991) MAGNETIC SOLENOID 12VOLT/ 10 WATTS(1991 & ON)
3	01810910	MAGNETIC SOLENOID GASKET
4	01810909	MAGNETIC SOLENOID WIRE CONNECTOR
5	01810903 01810904	PLUNGER VALVE 3MM EXHAUST & AIR OUTLET VALVE PLUNGER VALVE 6MM FILL VALVE
6,7	01810103 01810101	WATER FILL VALVE ASSEMBLY COMPLETE(6MM) AIR OUTLET & EXHAUST VALVE ASSY. COMPLETE(3MM)

E.A.H. 3/17/2003

8.3.2 Mechanical Checks

After removing 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.
Insure that the Plunger is able to move in and out of the sleeve freely, if not then 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 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 any time the LM34 Temperature Sensor or the Digital Predg Board are 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 the temperature reading on the display is still incorrect then check the voltage between TP5 and TP1 on the Ajunc2 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 then the reading at TP5 will be 72 degrees x 0.01 volts or 0.72 volts)

If the reading at TP5 appears good then 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 then replace the LM34 Temperature Sensor [see sec 10.3].
If the Temperature Sensor is good then the problem is in either the Digital Predg Board or the cable connection between the Ajunc2 Board and the Digital Predg Board. Replace either the cable or the Digital Predg Board or both.

While there are no components on the Ajunc2 Board that are used for the temperature circuit, it is possible that there could be a bad solder joint on the Ajunc2 Board. This is usually detectable by putting pressure on the connector on the back of the Ajunc2 or the main cable going to the Digital Predg Board. If applying pressure causes a change in the readings then a connection problem can be suspected and in this case changing the Ajunc2 Board is recommended.
The normal path of the signal will be to come into the Ajunc2 Board and go directly to the Digital Predg Board through the connecting cable.

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 Ajunc3 Board is changed
Disconnect the temperature sensor from the JP11 connector on the back of the Ajunc3 Board and proceed with either method.

Method 1: Using the PT-100 Simulator

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 Ajunc3 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 then replace the Ajunc3 Board
If it is not possible to adjust Pot 5 to the correct voltage then replace the Ajunc3 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 Ajunc3 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**.
If it is not possible to adjust Pot 4 to –5.1mv then replace the Ajunc3 Board
If it is not possible to adjust Pot 5 to the correct voltage then replace the Ajunc3 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 then 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 then replace the PT-100 Temperature Sensor [see sec 10.3]

If a PT-100 Simulator or a 151-ohm resistor are not available then obtain a resistor with a value as close as possible to 151-ohms. Using the following formula, recalculate the adjustment voltage for this <u>new</u> resistor value:

[(<u>new</u> resistor – 100) / 51.4] x 2.385 = voltage to adjust <u>Pot 5</u>

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

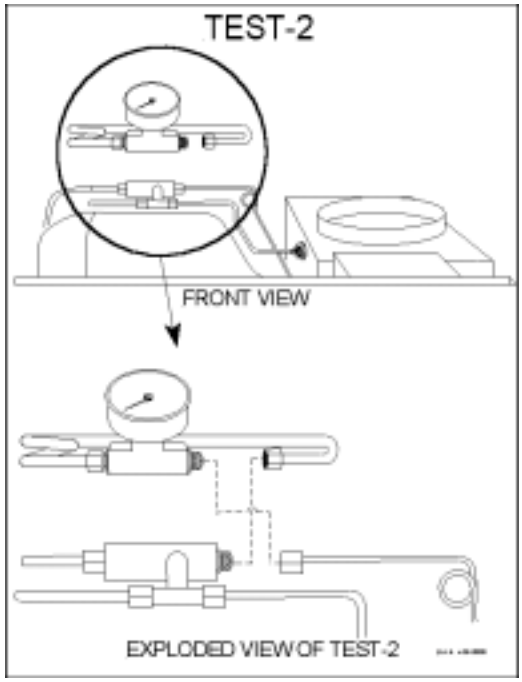
This procedure needs to be done anytime either the MPX201 Pressure Sensor or the Ajunc2 Board is replaced.
The autoclave should be on, but not running a cycle

Zero Adjustment Procedure

Connect a voltmeter to TP2 and TP3 on the Ajunc2 Board
Adjust Pot 1 on the Ajunc 2 Board for 0 volts DC.
If this adjustment can not be made then replace the Pressure Sensor or Ajunc2 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 gage.
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 then connect a voltmeter across TP4 and TP1 on the Ajunc2 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 0.0641 mv.
If the readings obtained are not correct then replace the Pressure Senor or Ajunc2 Board in that order. [see sec 10.4 or sec 10.18]
If the readings are correct but the display is still inaccurate then 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 Ajunc3 Board is replaced.
The autoclave should be on, but not running a cycle

Zero Adjustment Procedure

Turn the autoclave off
Press and hold in the Door Switch
Turn the power on and hold the Door Switch for approximately 5 seconds.
The autoclave can compensate for any inaccuracy in the Zero display up to 10%
If this adjustment can not be made then replace the Pressure Sensor or Ajunc3 Board in that order. [see sec 10.4 or sec 10.18]

Gain Adjustment Procedure

Connect a voltmeter across TP4 and TP1
Adjust Pot 2 on the Ajunc3 Board so the meter reads 500 mv DC (+/- 5mv)
If this adjustment can not be made then replace the Pressure Sensor or Ajunc3 Board in that order. [see sec 10.4 or sec 10.18]
If the display is still incorrect or inconsistent then connect a voltmeter across TP4 and TP1 on the Ajunc3 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 0.0333 mv.
If the readings obtained are not correct then replace the Pressure Senor or Ajunc3 Board in that order.
If the readings are correct but the display is still inaccurate then replace the Digital Predg Board.

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 date code (ex. T97DN7WP) skip to sec 8.6.4**,** all other units continue on.
The Chamber should be empty of any instruments, trays or leftover water.
The autoclave should be turned off
The Chamber pitch needs to be adjusted correctly
Measure out the proper amount of water for the appropriate model unit as listed below:

1730 = 10 oz (300ml)
2340 & 2540 = 12 oz (350ml)
3850 = 20 oz (600 ml)
3870 = 24 oz (750 ml)

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

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 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

Then 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

Then 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 Microprocessors containing the letters **WP** at the end of the date code (ex. T97DN7WP) the water filling the Chamber could run out the Door. Be prepared to catch this water in a bucket. When the unit has finished filling, measure all the water in the Chamber and in the bucket it should be approximately 550 ml

If the water fill is not working correctly then 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 date code ending in **WP** will have a Water Pump installed to insure proper filling.

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, then 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 = 30 sec
   2540 = 35 sec
   3870 = 65 sec

   now press the **STOP Key**
5. 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.
6. 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, then 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 then 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 meter reading does not change correctly then 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 then there is a control problem [see sec 7.20]
If the test is successful, it then 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.

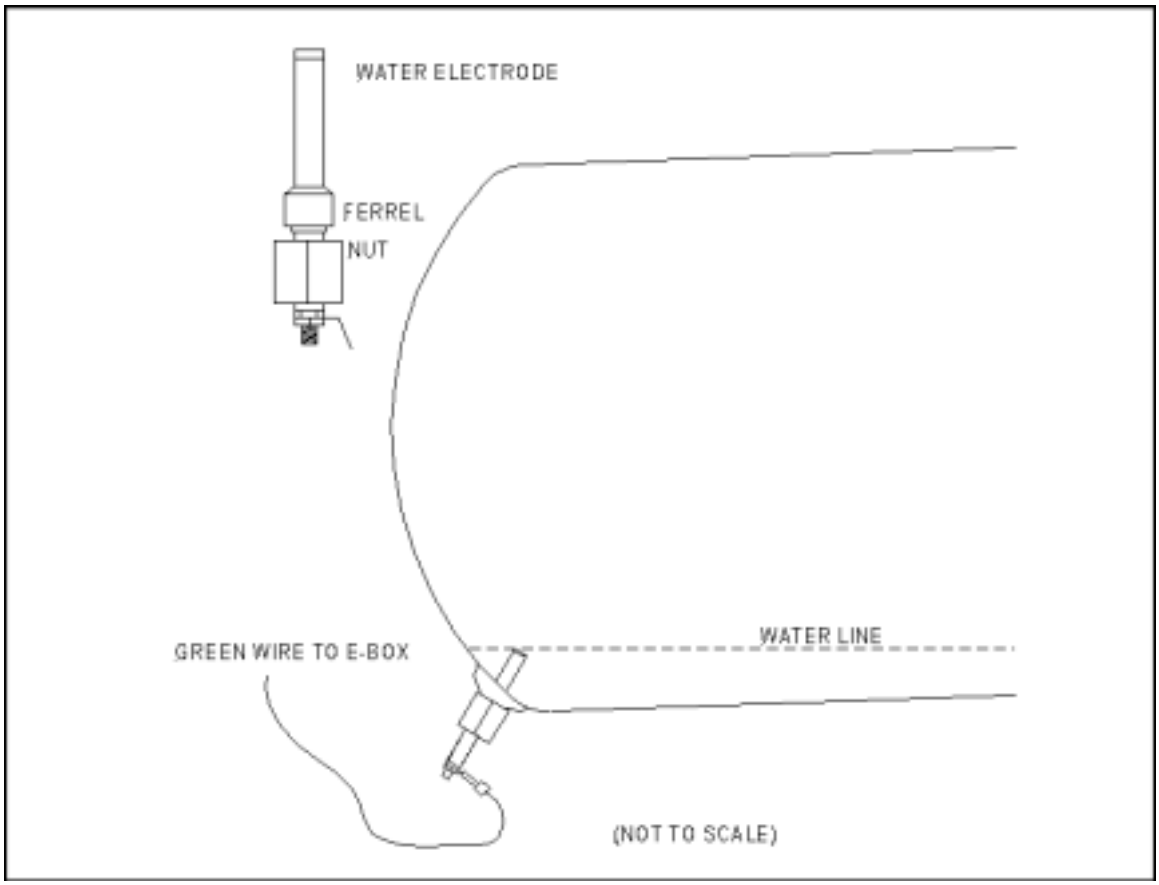
8.7.2 Testing the Electrode with an ohmmeter

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 shows any continuity then there is a problem with the Electrode and it should be replaced. [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 Safety Thermostat Testing

8.8.1 Testing Overview

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

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

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

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

This thermostat is installed on the autoclave to act as a safety device that detects over heating 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 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 Safety Thermostat.
If the autoclave is not hot and the device has not automatically reset then replace the Safety Thermostat.
Otherwise reconnect the two wires and check else ware for the source of the problem

8.8.3 Testing if the device trips to soon

If the Safety Thermostat is hard wired then unplug the unit and remove the two wires
Connect the two wires together
Connect an ohmmeter across the two empty terminals of the 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 then replace the Safety Thermostat
Otherwise reconnect the two wires and check else ware for the source of the problem

If the Safety Thermostat is wired to the Microprocessor **and** the unit has an Ajunc2 Board then connect a meter to the **small** green wire on the 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 then, replace the Safety Thermostat.
Otherwise check else ware for the source of the problem

If the Safety Thermostat is wired to the Microprocessor **and** the unit has an Ajunc3 Board then 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 then, replace the Safety Thermostat.
Otherwise check else ware for the source of the problem

To further test a unit where the Safety Thermostat is connected to the Microprocessor and also has an Ajunc3 Board
Turn the unit on
Connect a voltmeter between TP22 and TP1.
Remove the thin green wire that connects the Safety Thermostat to the

Microprocessor, make sure however that the JP2 connector on the back of the Ajunc3 Board is connected properly.

Now 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 1volt DC and then 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 devices that detects over heating 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 can not be reset then replace the Cut-Out Thermostat.
Otherwise reconnect the two wires and check else ware for the source of the problem

8.9.3 Testing if the device trips to 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, then replace the Cut-Out Thermostat

Otherwise reconnect the two wires and check else ware for the source of the problem

8.10 Dip Switch Selection

The dip switches are used to set four different parameters. The dip switches operate up and down, up being on and down being off. The dip switches are numbered from left to right.

8.10.1 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 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 access to changing 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, Stand by 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 it will switch itself off until the next time it is used. This switch is always on in all **EK**, **EKA**, **3850E** and **3870E** models

Switch # 4 on = mode on

4 off = mode off

8.10.4 Printer

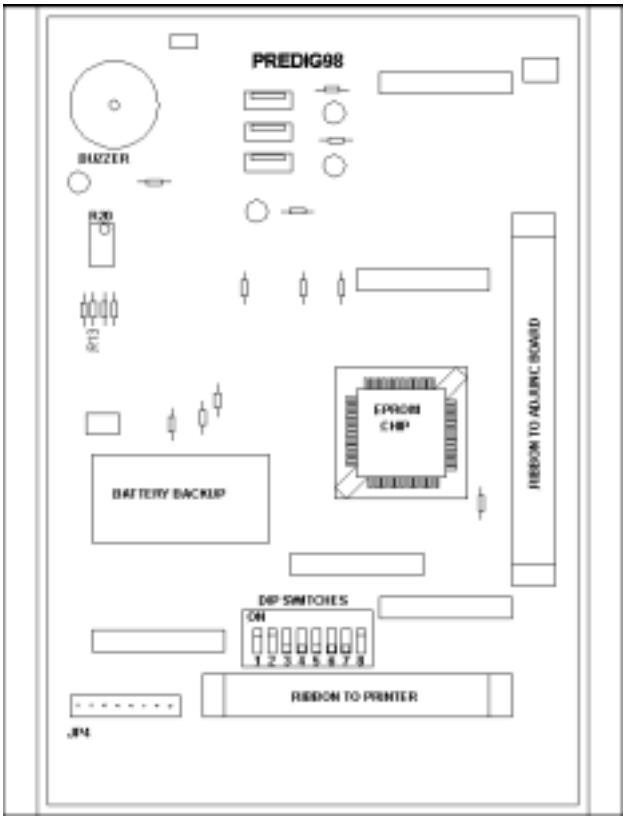
Switch # 8 turns the Printer option on or off. If no Printer is present then the switch can be in any position.

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

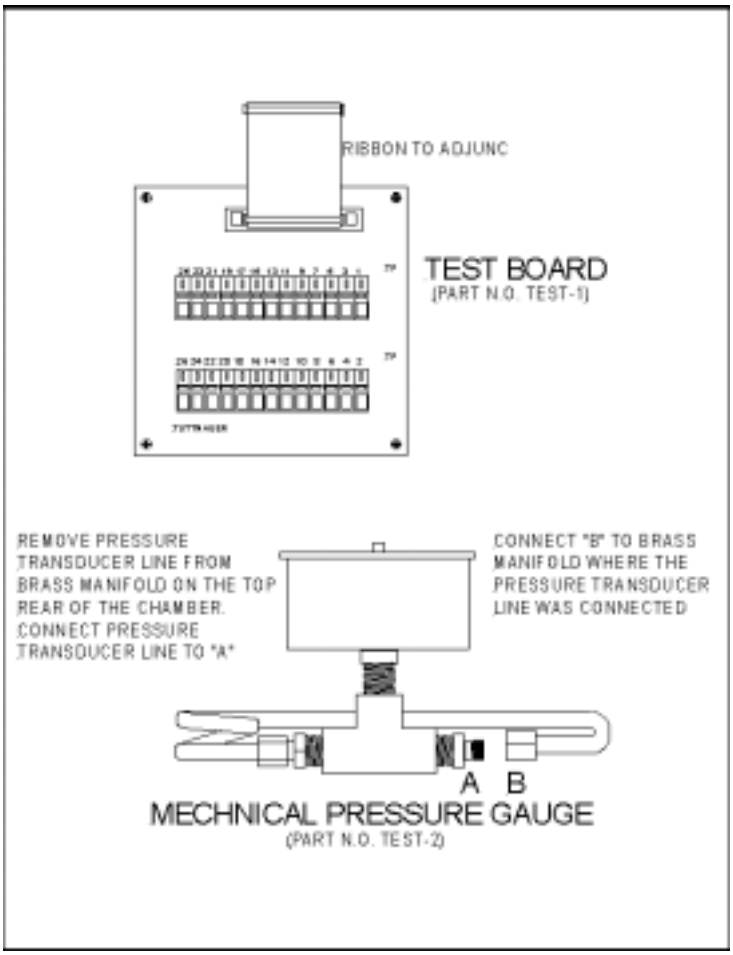
8.11 Available Test Equipment

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 hunt and fish around 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**

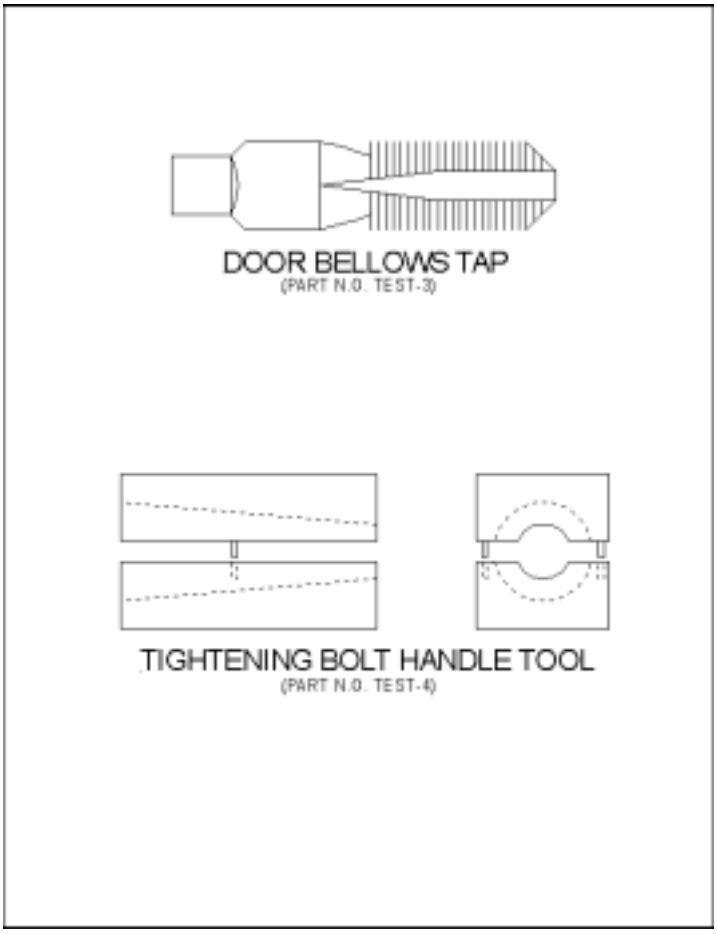


8.11.3 Door Bellows Tap

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, with out marring or otherwise damaging the handle, while removing or installing into the Closing Device.
The part number is **Test-4**

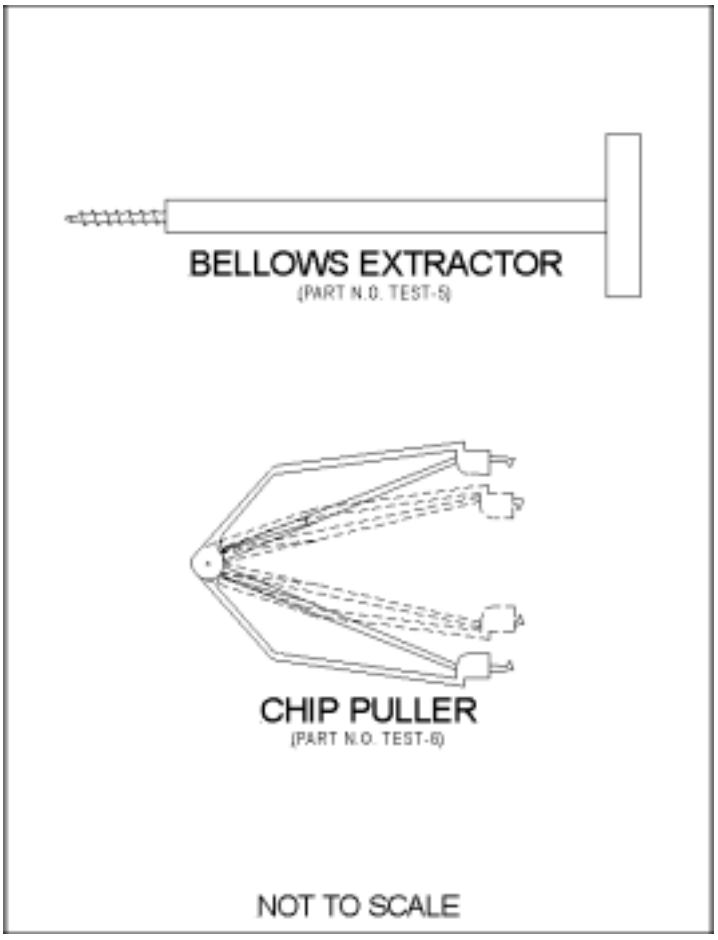


8.11.5 Bellows Extraction Tool

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 autoclaves 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 relive 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 chose because the temperature can be read all during the cycle, this makes calibration much easier.
   The best location for the thermal couple 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 capablity 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 Date Code

There are two ways to find the **Date Code** for the Microprocessor

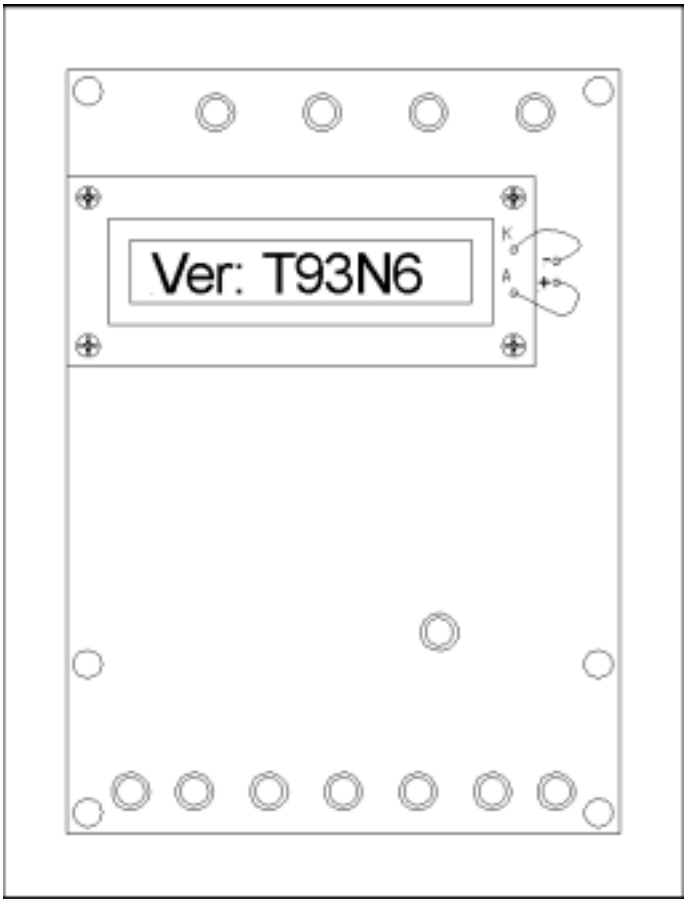
1. Cycle the unit off and on

   Using the On / Off Rocker Switch turn the power off.

   Now using that same On / Off Switch turn the power on and observe the Display Screen. The **Date Code** version number will be the first information displayed.

2. Printer Tape

   The first information that is printed before each cycle is the **Date Code** version number.



8.13 IN-OUT Test – available only on units with software version T97N6 and newer

Before performing any trouble shooting 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 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 button.
4. To advance to the next test press the UP button for one second. Each time the UP 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 water enters the chamber
EXH	Exhaust valve	—
HEATERS	Heating elements	Begins heating. **Caution** 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	Reservior float indicates "no water"	Change position of the float switch and verify that the display reflects the change.
FLOAT 0	Reservior 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 O	Safety thermostat grounded	—
THERM 1	Safety thermostat 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

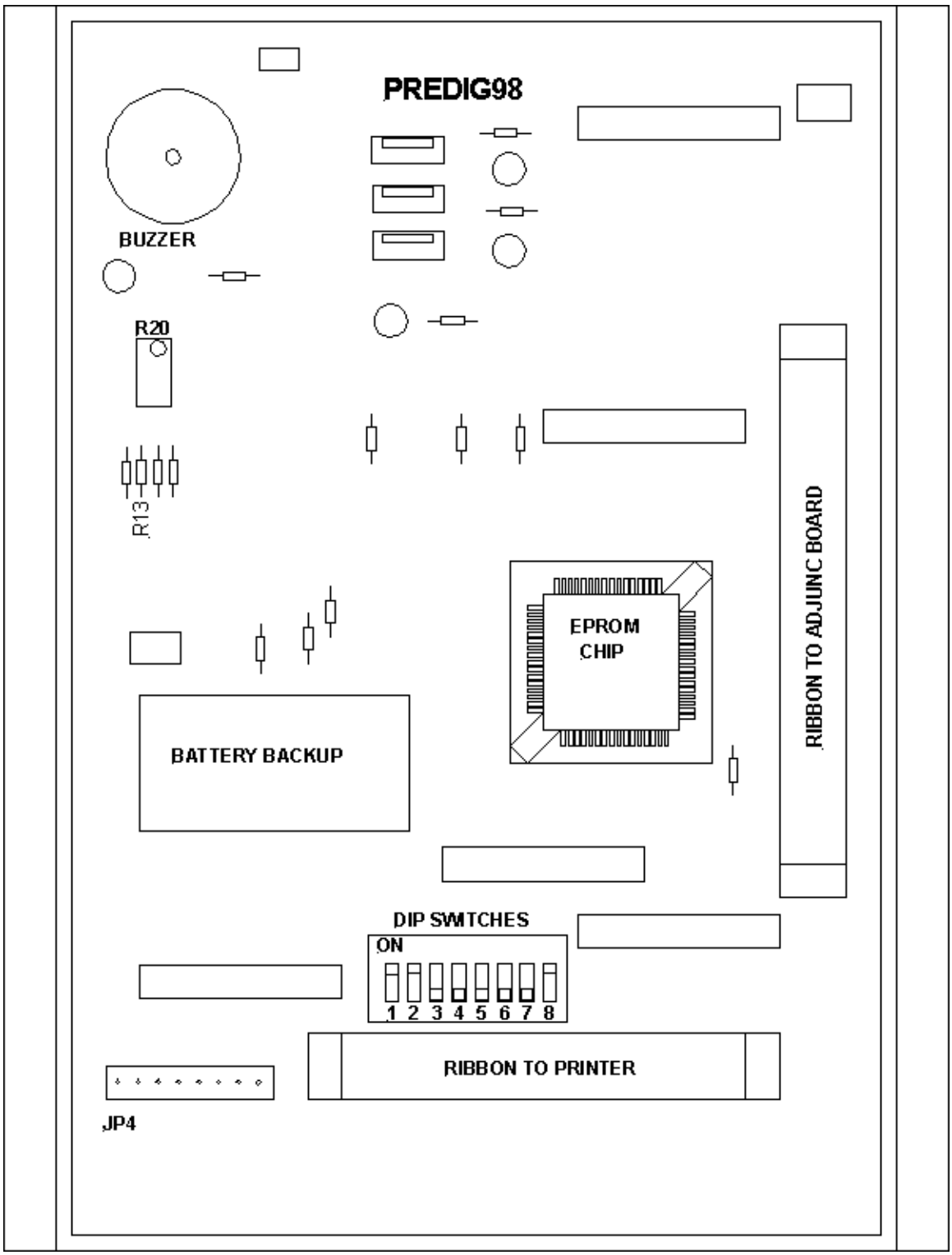
The heating elements on the Electronic Units are wired in a parallel configuration. Therefore the ohm readings taken on the Electronic Units can be taken across the two terminals of any heating element with the same result

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
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

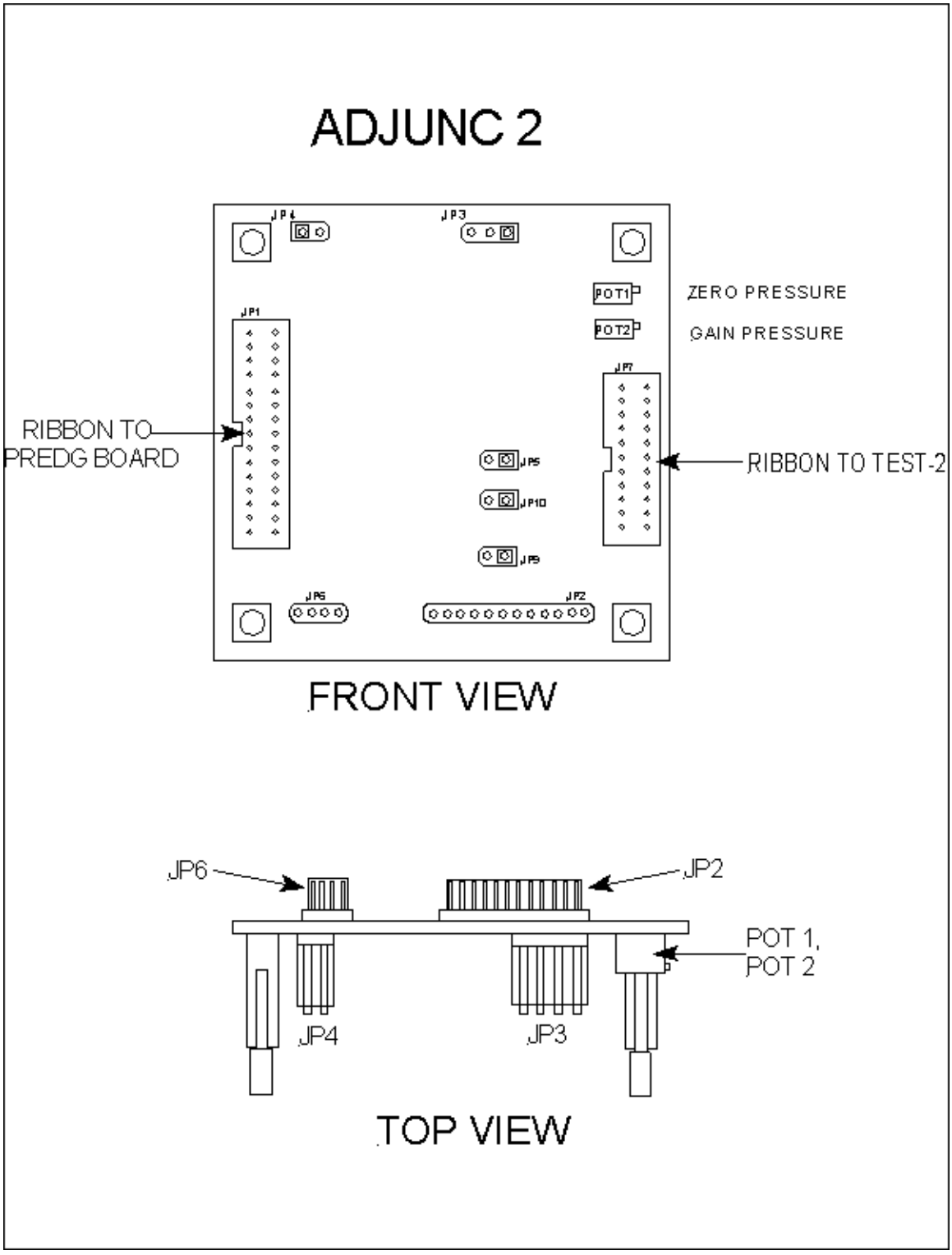
** All readings in this table are + / - 10%

It is **important** whenever 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 – 12 Meg ohms.

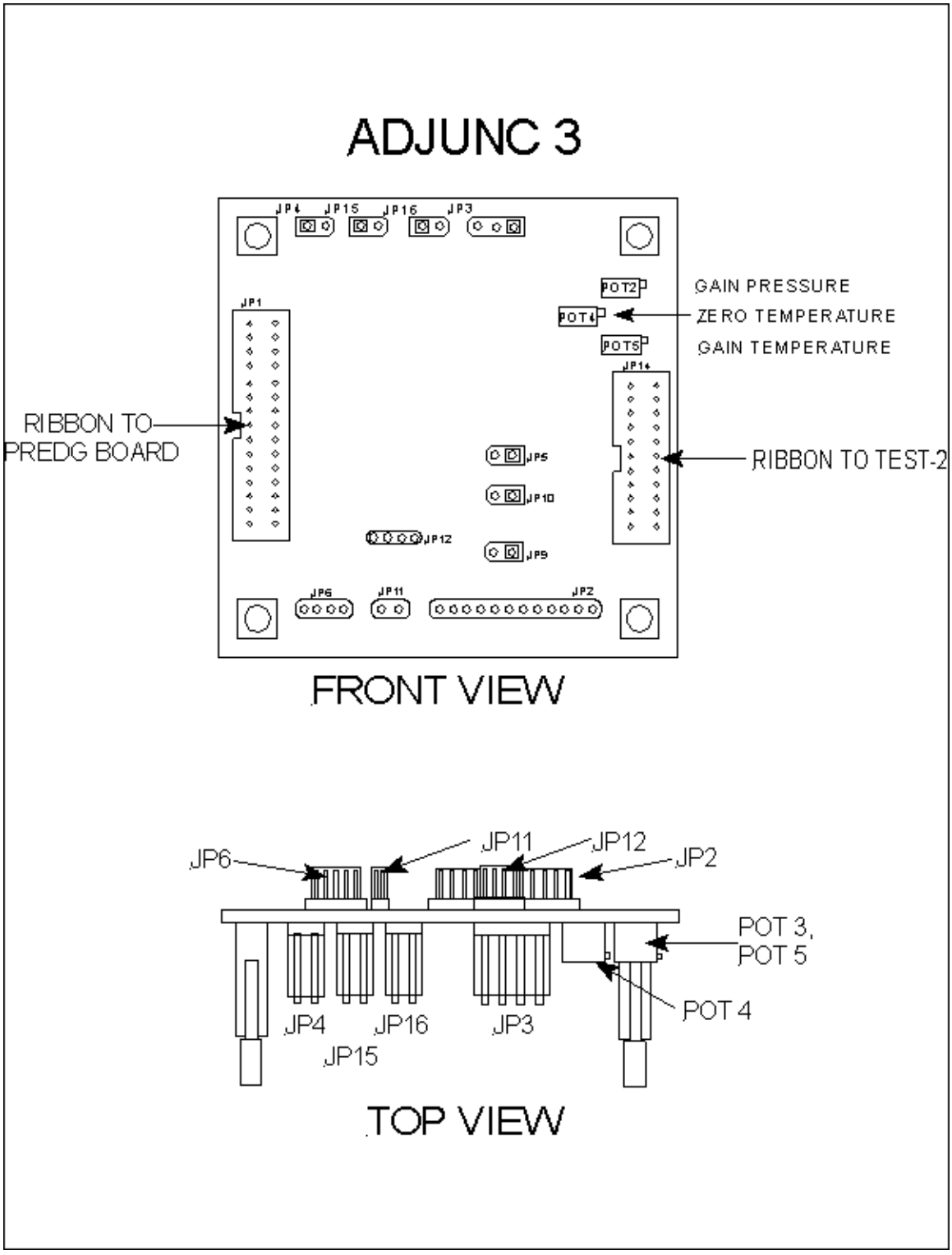
The heating elements on these electronic units are always operating at full power. The microprocessor controls the power by switching the heaters on and off at different rates



9.2 Digital Predg Board



9.3 Ajunc 2 Board Basic Layout

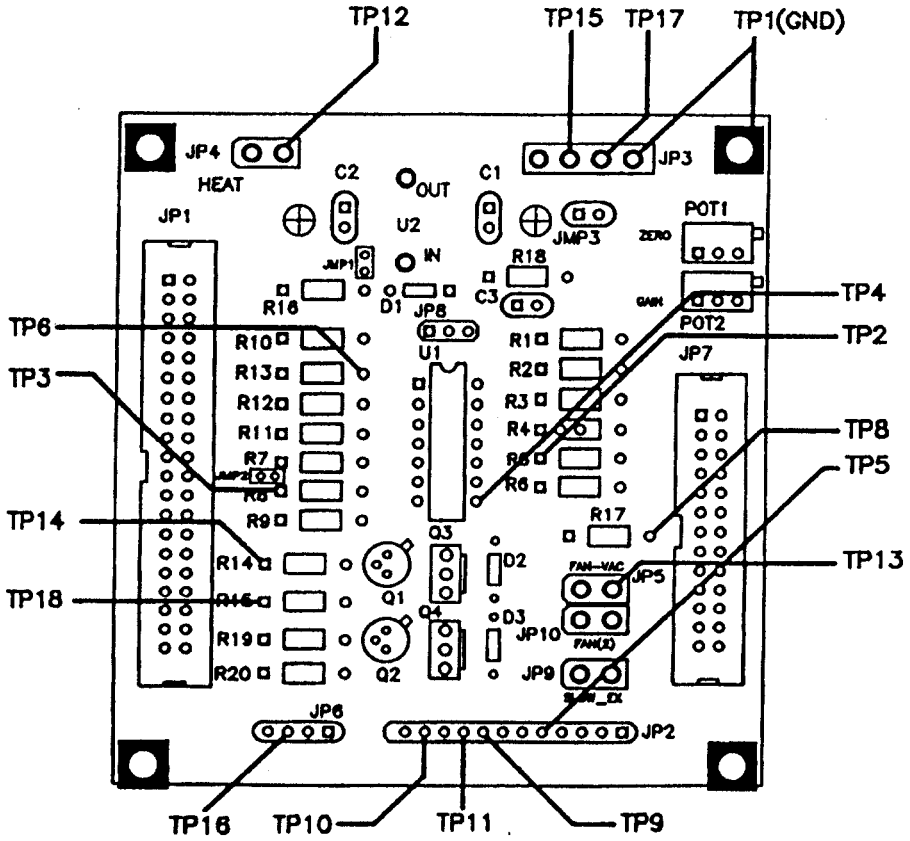


9.4 Ajunc 3 Board Basic Layout

9.5 TEST POINTS FOR AJUNC 2 BOARD 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		

AJUNC2 BOARD – TEST POINTS



9.6.1 TEST POINTS FOR AJUNC 3 BOARD
SOFTWARE VERSION 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	151.4Ω = 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	Safety Thermostat	0 to 1 v = closed circuit 3.5 to 5 v = open circuit
TP25	PT100 Zero Temperature Adj	100Ω = –5.1 mv
TP26	PT100 Zero Temperature Adj	100Ω = –5.1 mv

9.6.2 TEST POINTS FOR AJUNC 3 BOARD
SOFTWARE VERSION T97DN7WP AND BEYOND

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	151.4Ω = 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	Safety Thermostat	0 to 1 v = closed circuit 3.5 to 5 v = open circuit
TP25	PT100 Zero Temperature Adj	100Ω = –5.1 mv
TP26	PT100 Zero Temperature Adj	100Ω = –5.1 mv

9.7 Maximum Instrument Load

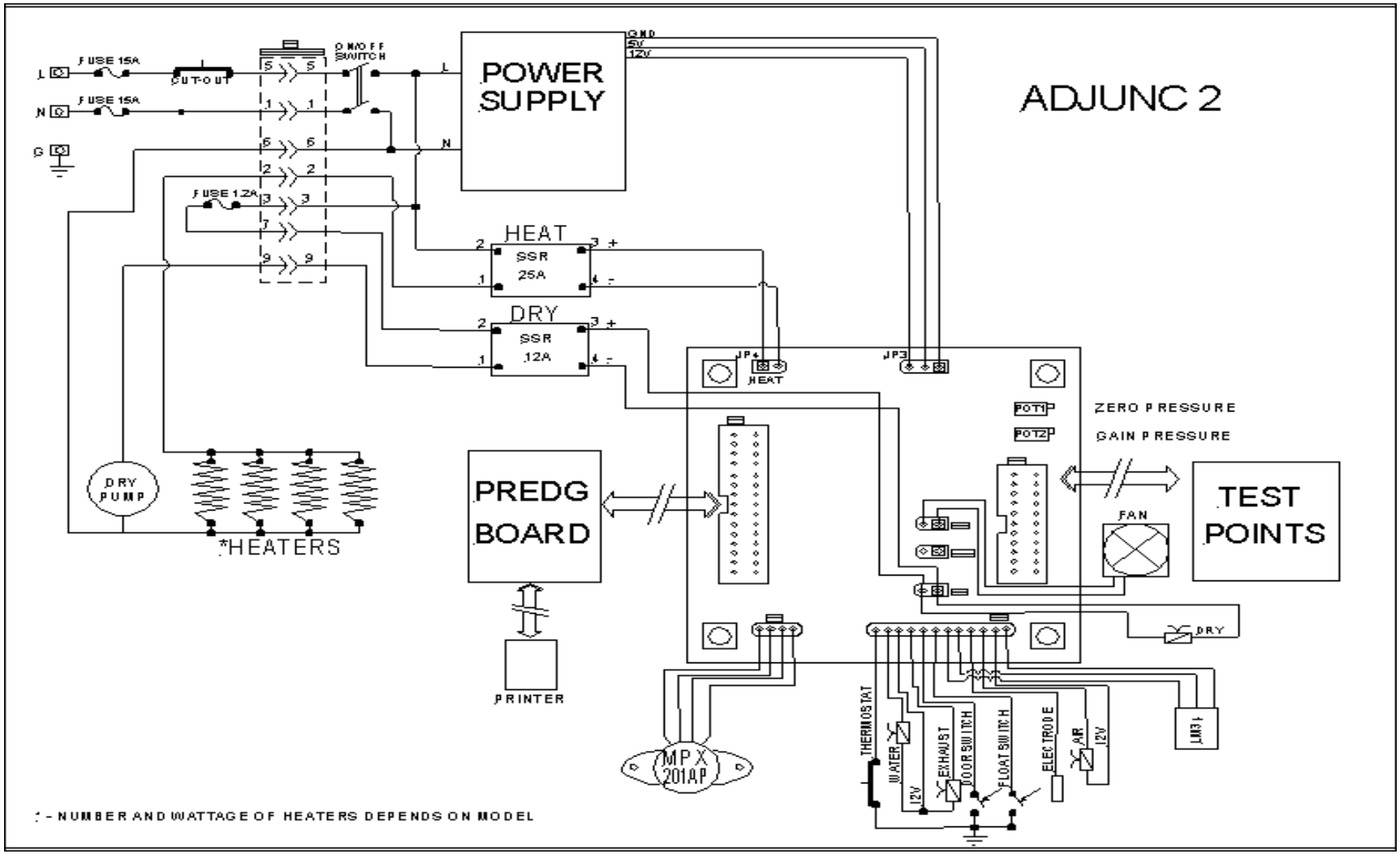
In order for the autoclave to perform sterilization cycles according to the published specifications the Maximum Instrument Loading must be observed. It is best if this load is spread out among all the available trays. Do not exceed this load for optimum performance.

Model	Max Instrument load
1730	3.3 lbs (1.5 kg)
2340	7.0 lbs (3.2 kg)
2540	8.8 lbs (4.0 kg)
3850	13.6 lbs (6.0 kg)
3870	17.5 lbs (8.0 kg)
EZ9	7.0 lbs (3.2 kg)
EZ10, EZ10k	8.8 lbs (4.0 kg)

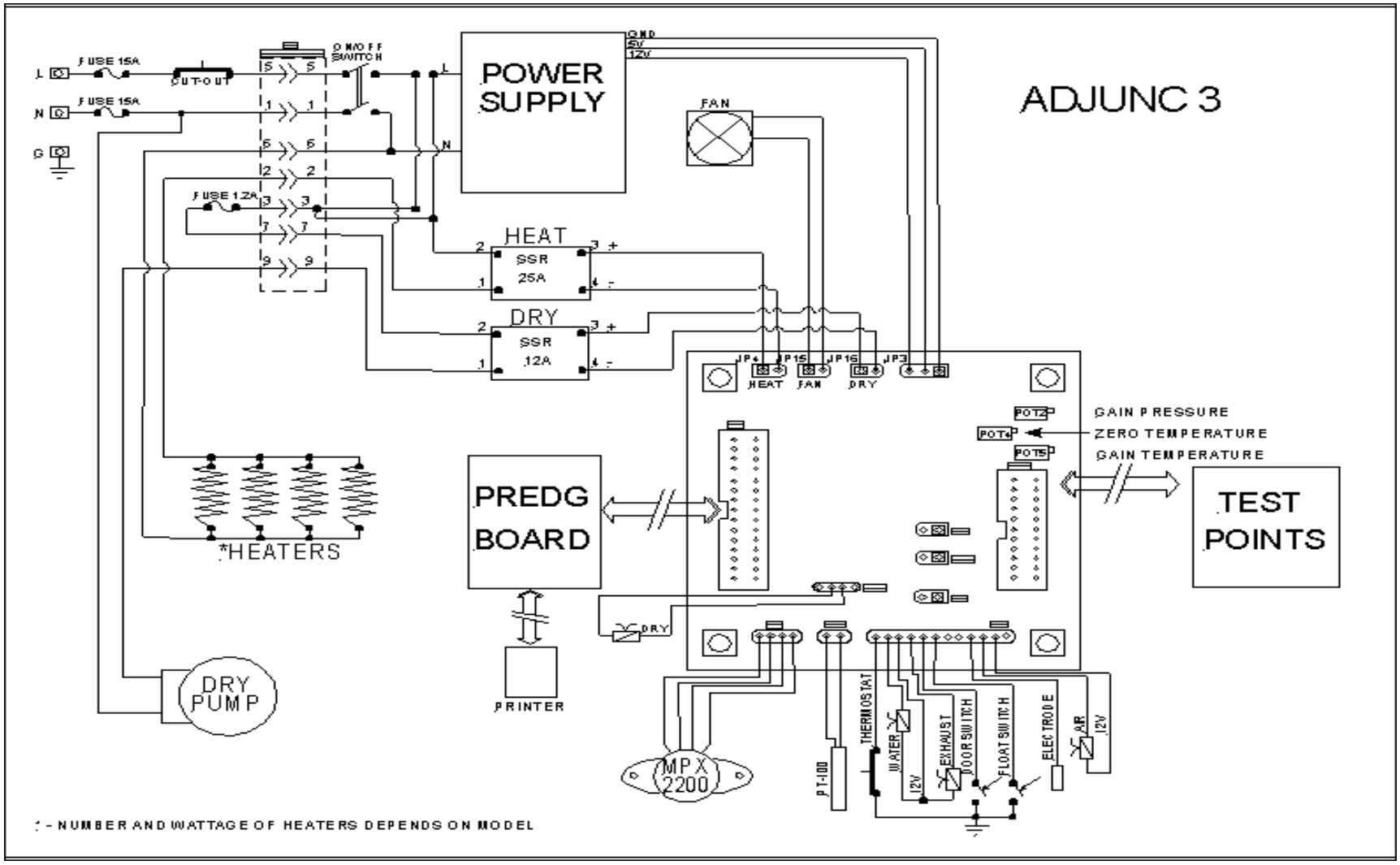
9.8 Maximum Liquid Load

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.

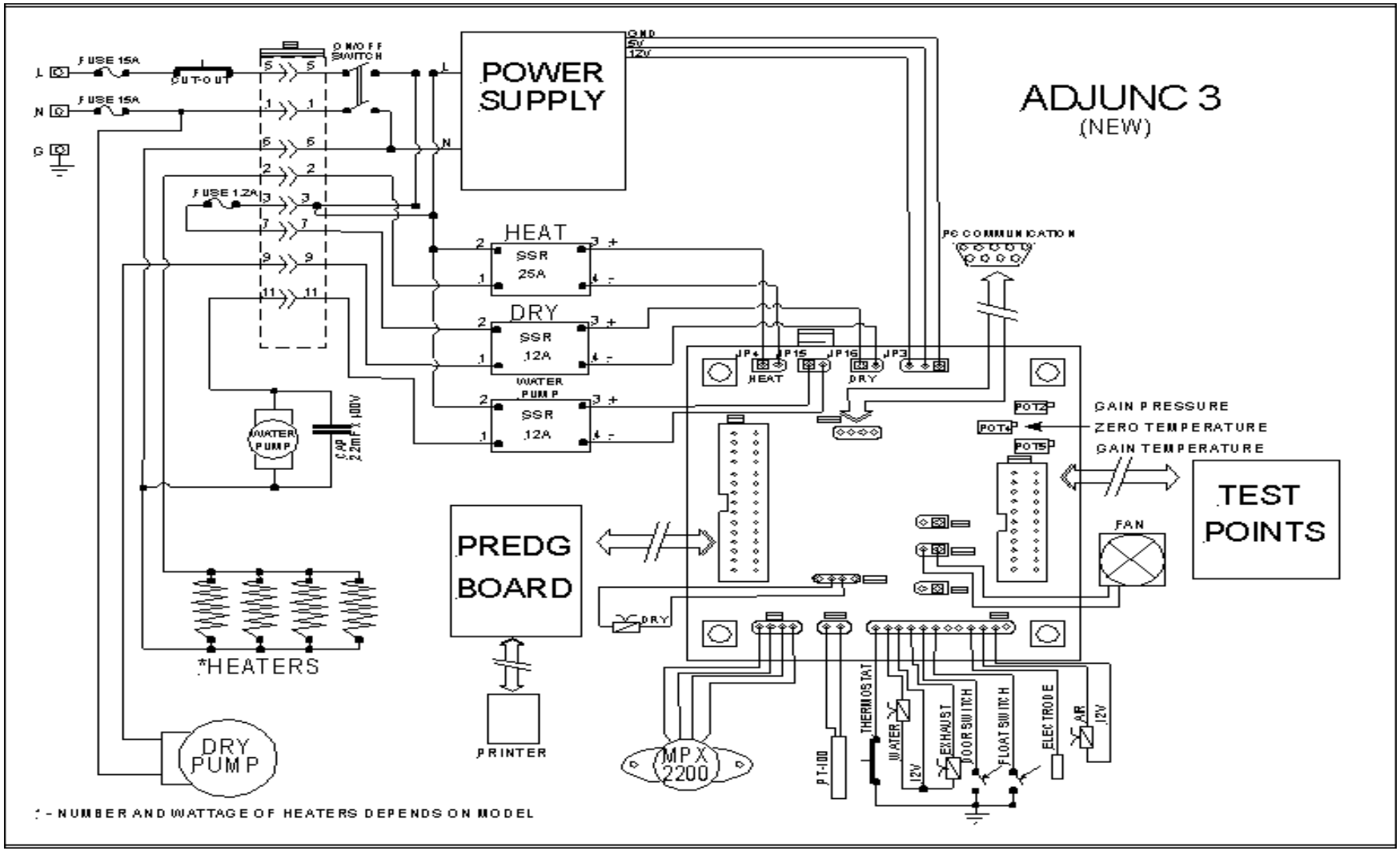
Model	Maximum Liquid Load
1730	16.9 oz (500 ml)
2340	67.6 oz (2.1 qt) (2.0 liter)
2540	84.5 oz (2.6 qt) (2.5 liter)
3850	223.9 oz (6.9 qt) (6.6 liter)
3870	287.3 oz (8.9 qt) (8.5 liter)
EZ9	67.6 oz (2.1 qt) (2.0 liter)
EZ10, EZ10k	84.5 oz (2.6 qt) (2.5 liter)



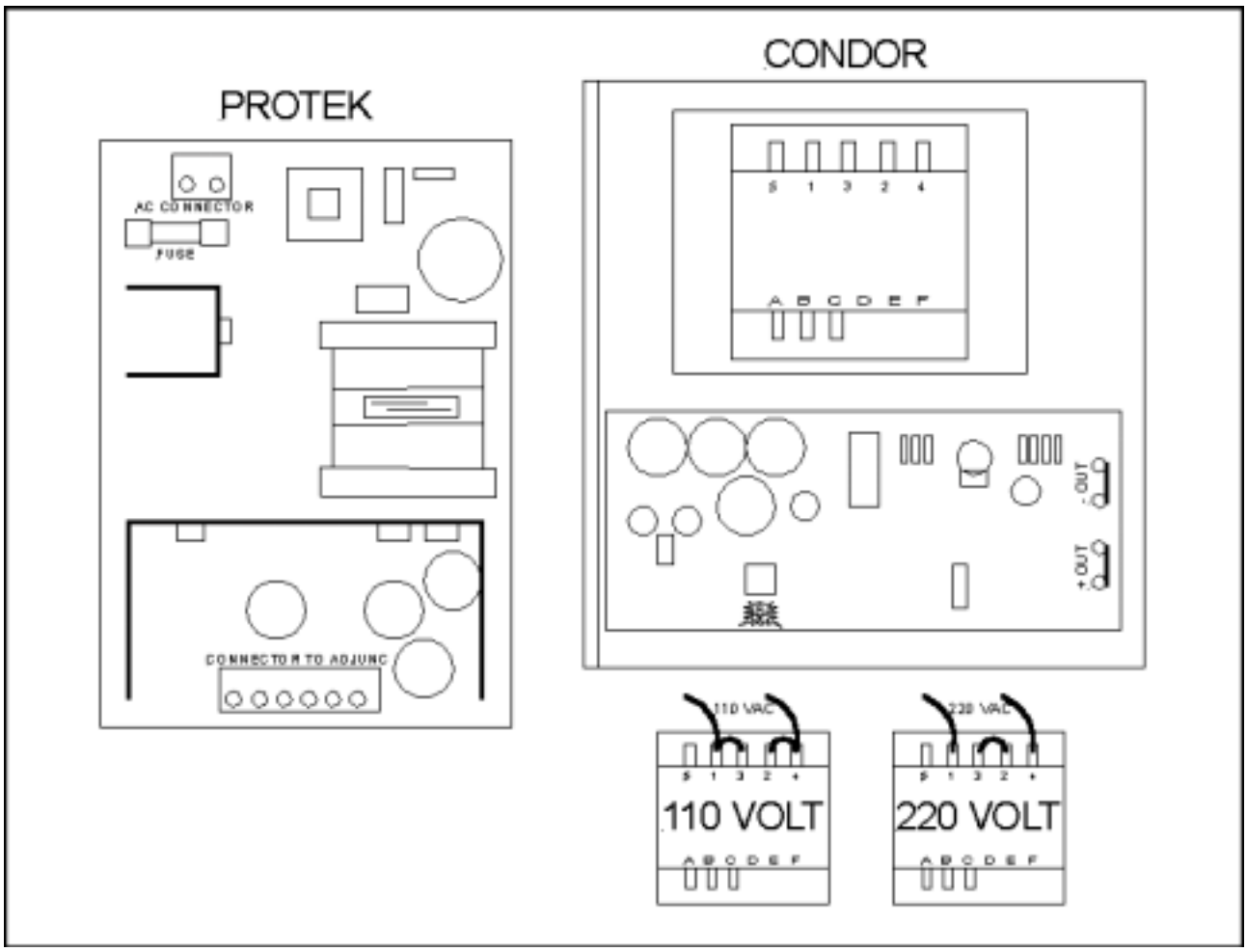
9.9.1 Ajunc 2 Board Schematic



9.9.2 Ajunc 3 Board Schematic – Microprocessor version <u>without</u> WP



9.9.3 Ajunc 3 Board Schematic – Microprocessor version with WP



9.10 Power Supply

9.11 LM34 Cross Reference Table

Wire Coding for installation of the LM34 or LM34 Replacement Kit Temperature Sensors

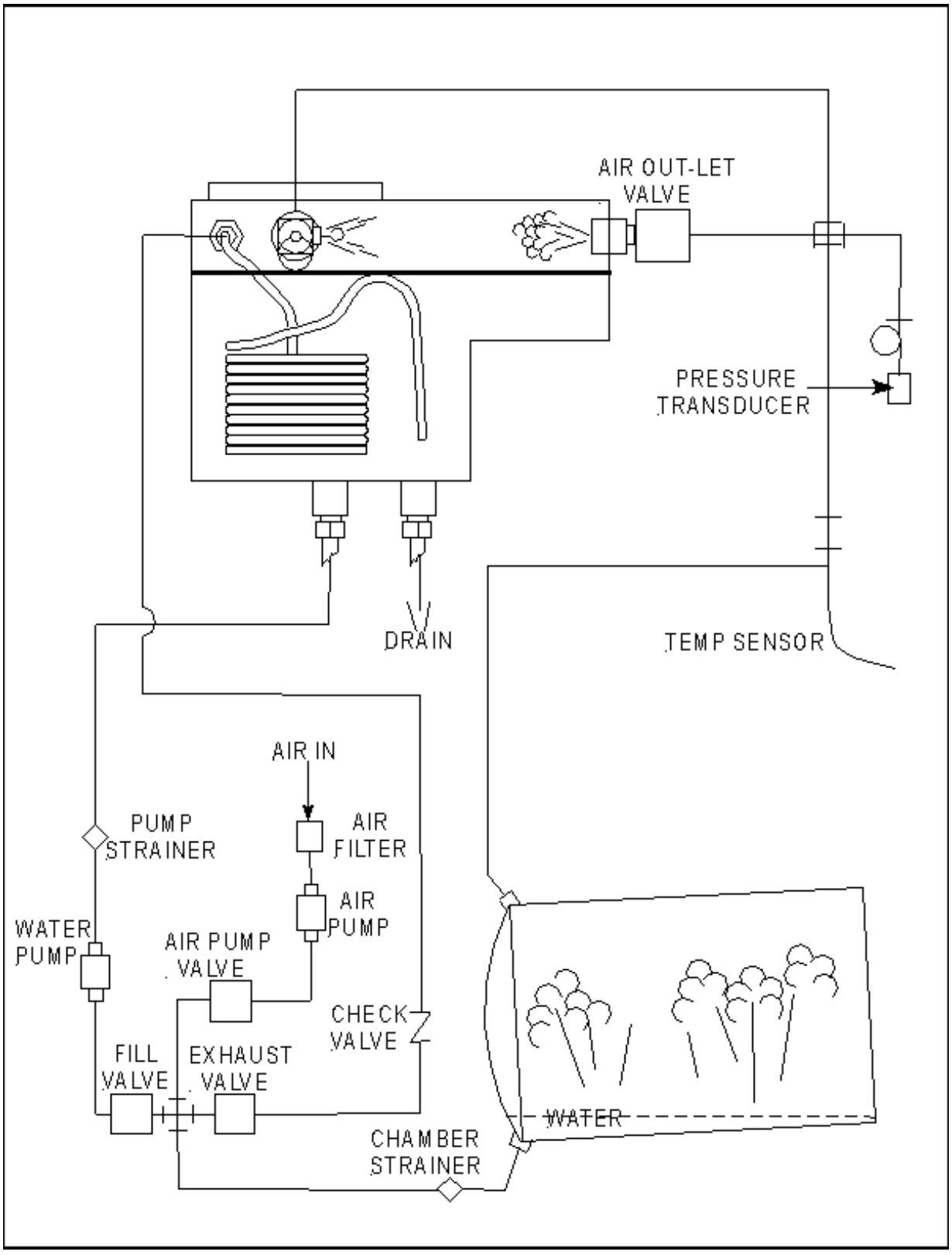
When changing the LM34 temperature sensing device, match the color coding in the table below to the style sensor you received. The pin number in the left hand column refers to the connector that plugs into the back of the Ajunc2 board. With the connector plugged into the Ajunc2 board pin # 1 will be 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 Ajunc2 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

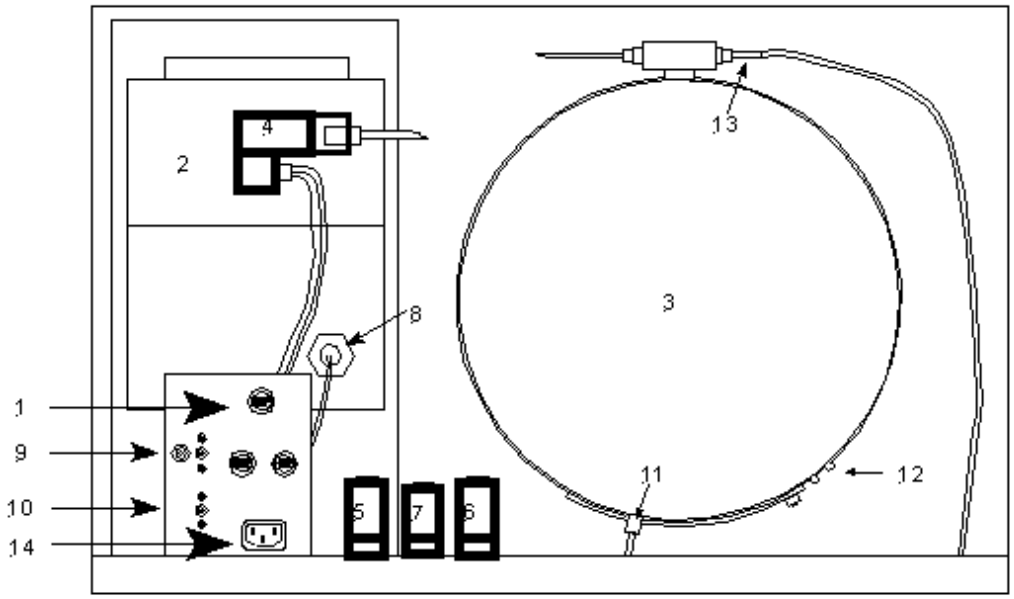
LM34 REPLACEMENT



9.12 Solenoid Valve Schematic

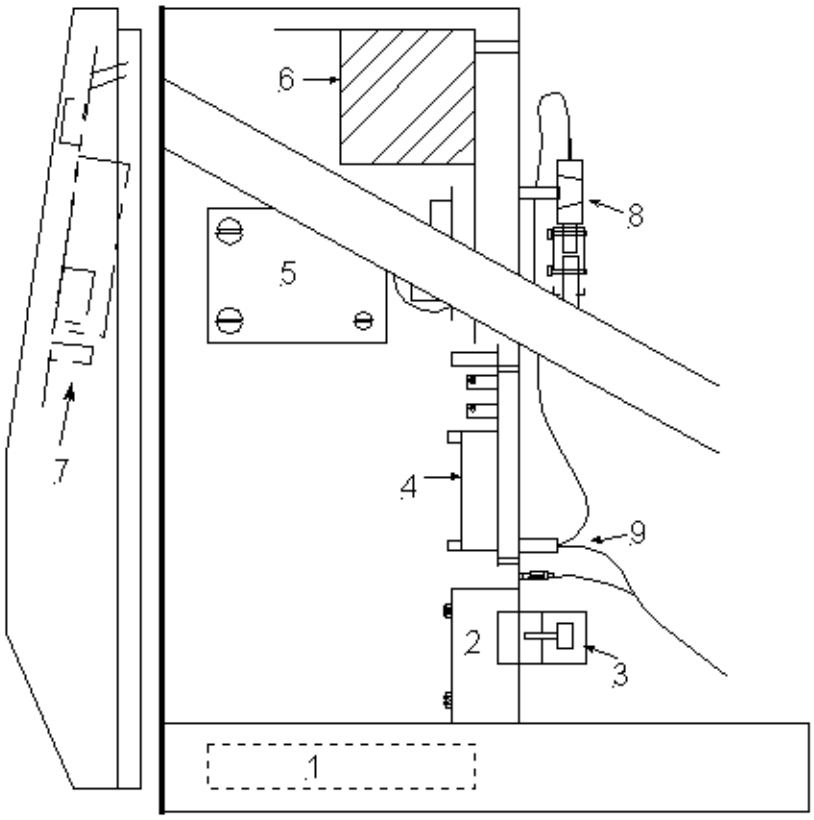
REAR VIEW COMPONENTS

1 - optional fuse
2 - water resevoir
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



9.13 Autoclave Rear View

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



ELECTRICAL BOX (RIGHT SIDE VIEW)

9.14 Autoclave Electronic Box Components

9.15 Chamber Brite Cleaning Instructions

INSTRUCTIONS FOR CLEANING TABLE TOP AUTOCLAVES 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. Start a sterilization cycle* **with water** and **No Drying Cycle** according to the manufacturers instructions. When the cycle is finished exhaust the unit.
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. Start a sterilization cycle* **with water** and **No Drying Cycle** according to the manufacturers instructions. When the cycle is finished exhaust the unit.
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. For M/MK models, turn fill knob to fill position and allow a small amount of water (2-4 ounces) to fill chamber. Remove water from chamber. For all "E" series models, 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!!!

CAUTON: 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.

Use two packets of CHAMBER BRITE in autoclave exceeding a chamber volume of six gallons. Clean every 20 cycles or as needed.

* Total cycle time for cleaning Tuttnauer "M" series is 30 minutes at 273ºF
Total cycle time for cleaning Tuttnauer "MK" series is 12 minutes at 273º F
On all Tuttnauer "E" series units, run a standard unwrapped cycle with 3-minute sterilization time at 273º F.
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 220 volt elements. We also have Kwiklave machines **EK, EKA** and **EZ10k**. (The 2340 and 2540 EK and EKA models are 220 volts. The 1730EK model is 110 volts. The EZ10k model is 22 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

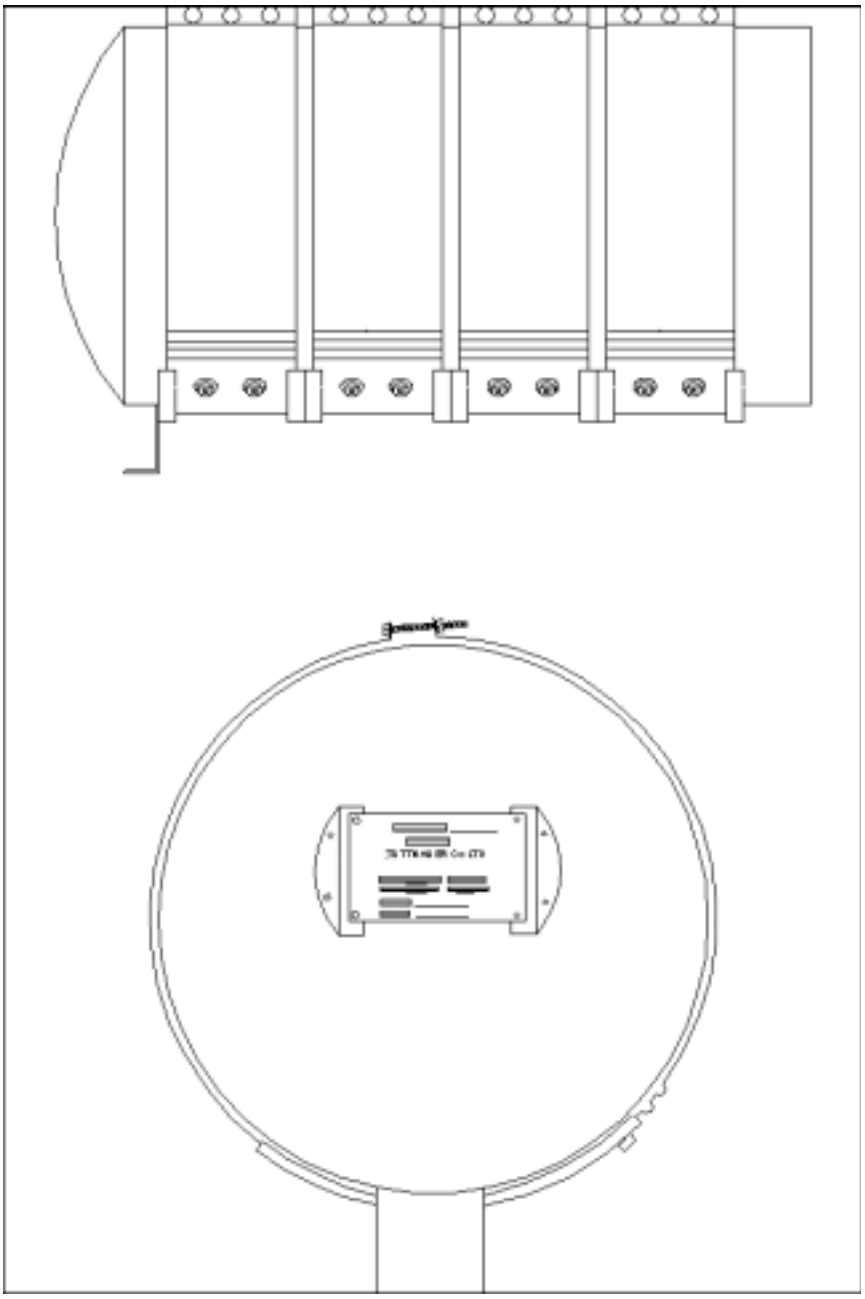
When removing or install the heating element wires **always** hold the terminal with a pair of pliers while turning the screw. If the terminal itself is allowed to twist and turn then there is danger that the internal connection to the element will be broken and the heating element will then be useless.

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 install 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 then there is danger that the internal connection to the element will be broken and the heating element will then be useless. Insure that the wire terminal is tight and that the terminal is

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 can not be used for proper centering do 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 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, then tightening the bolts will result in tightening the element. When the only the tops of tabs are moving toward each other then you're not tightening the elements any more, you're only deforming the tabs.
When tightening the elements it is important to make them tight. If the elements are not tightened properly then 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 over heating and shortening its life spa

10.2 Safety Thermostat Replacement

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

DO NOT ATEMPT TO ADUST 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 trouble shooting 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 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 lock nut, which ever method is being used to secure the device.

10.2.3 Remove the probe

Loosen the bolts on the rear most Heating Element or which ever 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 that 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 lock nut that were 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 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 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 channels of the Heating Elements. If they are loose they will **not** make good contact with the Chamber and well **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 them
Be careful not to connect a high voltage wire to the ground terminal.
If the replacement device does not have a separate ground terminal then 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 Ajunc2 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 then 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 then 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 manifold attached to the Chamber. Tighten down the compression connector to secure the sensor in place

Route the Temperature Sensor cable to the back of the Ajunc2 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 9.11. Locate the catch on the pin, it should be in the up position when inserted into the connector. The window in the connector should like wise 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 Ajunc2 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 Ajunc3 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.

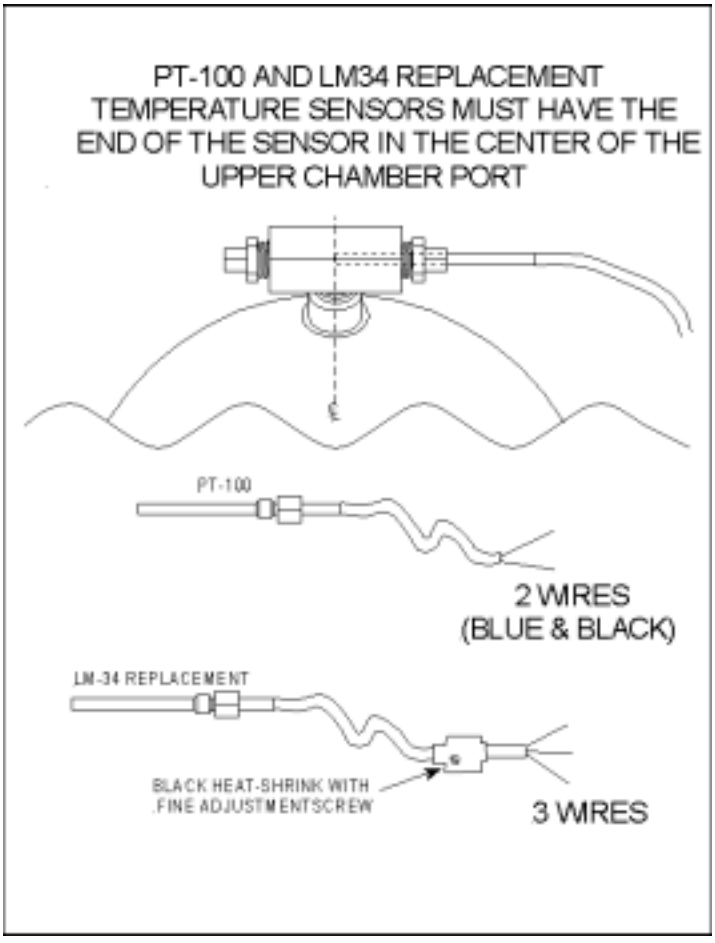
Once the wires are removed then unscrew the compression fitting and remove the Temperature Sensor from the manifold on the back of the Chamber

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 center of the manifold attached to the Chamber. Tighten down the compression connector to secure the sensor in place

Route the Temperature Sensor cable to the back of the Ajunc3 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 like wise 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 Ajunc3 Board



10.4 Pressure Sensor Replacement

There are two Pressure Sensors in use on the Electronic units. The MPX 201 is used with the Ajunc2 Board. The MPX 2200 is used with the Ajunc3 Board. Both Pressure Sensors are replaced the same way

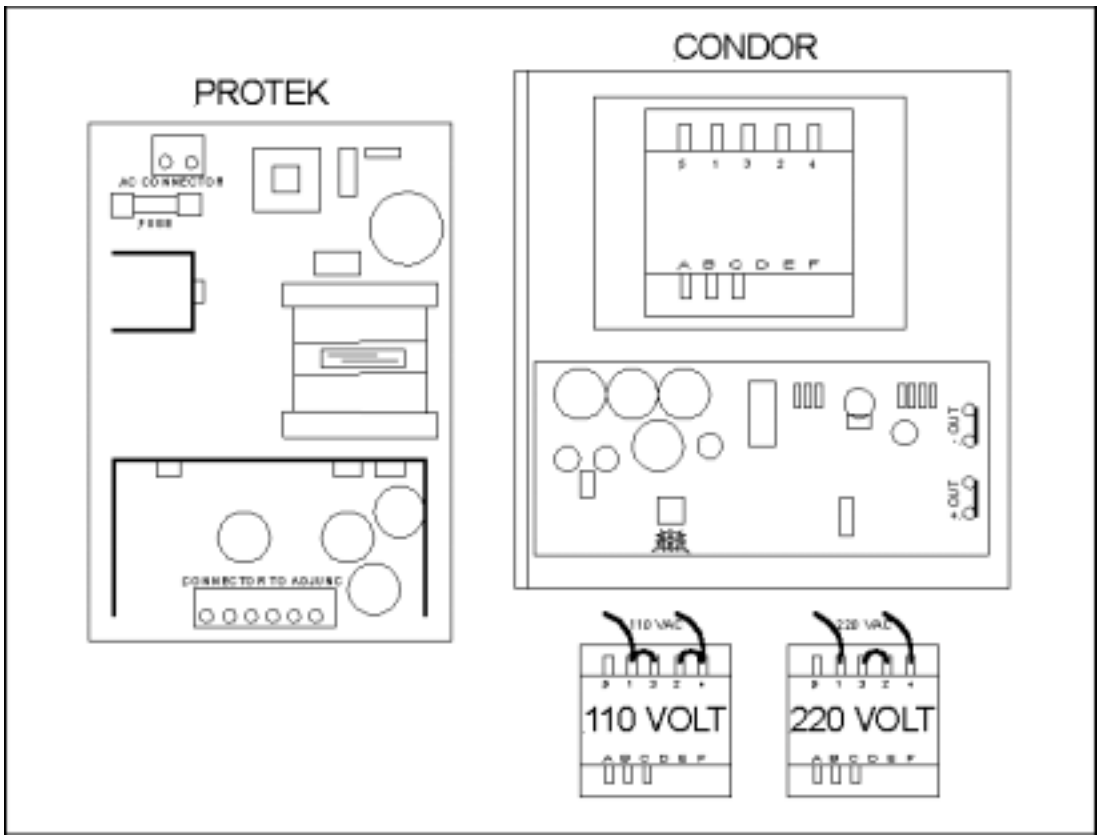
Unplug the unit
Unplug the JP6 connector. JP6 is a 4-pin connector on the back of both the Ajunc2 Board and Ajunc3 Board.
Cut the cable tie holding the silicone tube to the base of the sensor.
Remove the sensor from its mounting
Securely mount the new sensor
Reconnect the silicone tube and secure with 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

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 220 volts

Protek Power Supply has been used since 1996. It's 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 220 volt with out 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 Ajunc2 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 then soldered to terminals 1 and 4
For a 220-volt unit there needs to be a jumper wire soldered across terminals 2 – 3. The input wires are then soldered to terminals 1 and 4
Install the new Power Supply on to the screws and stand offs protruding from the back wall of the Electronic Box and secure in place with the nuts.
Connect the JP3 connector to the Ajunc2 Board
Secure the input wires with a new cable tie

10.5.1 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

10.5.2 Replacing a Condor supply with a Protek

Unplug the autoclave from the wall outlet
Remove the Outer Cabinet
Disconnect the JP3 connector from the Ajunc2 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.

If the unit has a Power Transistor attached to the Ajunc2 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 on to the screws and stand offs 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

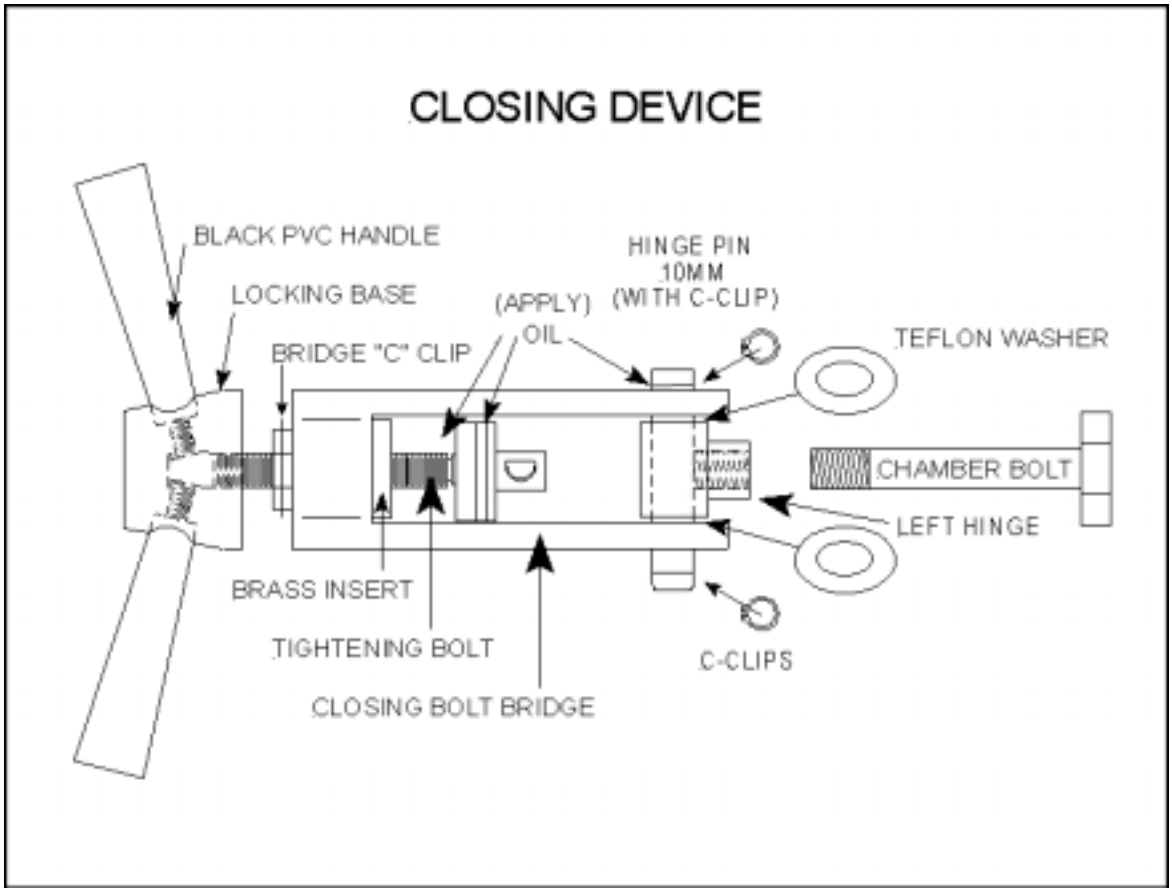
Plug the input power connector into the Power Supply

10.6 Closing Device

10.6.1 Closing Device Replacement

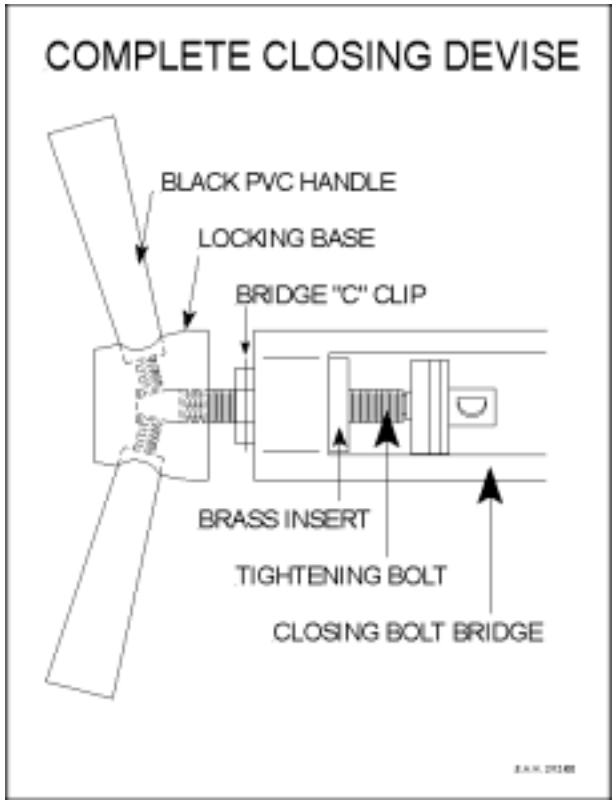
Using c-clip pliers remove the top and bottom C-clips
Remove the Hinge Pin and Closing Device
Inspect the Hinge Pin by rolling it along a flat surface and observing any irregularities in its movement.
If the Hinge Pin does not move straight and true then replace it.
Inspect the C-clips. If any signs of damage or distortion are present then 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 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.



10.6.2 PVC Handle Replacement

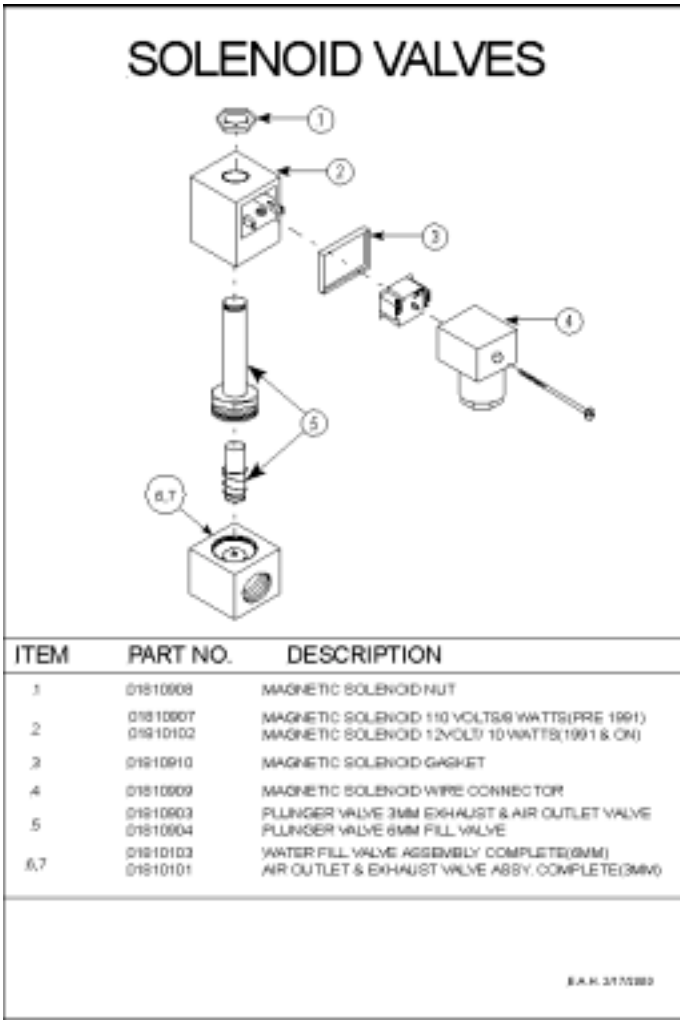
Remove the Closing Device from the autoclave
Unscrew the broken handle out of the Locking Base
Apply thread lock to the threads of the new handle
Screw the new PVC Handle into the Locking Base, making sure that the threaded shaft sits squarely on the flat of the Tightening Bolt
Using Test-4 (Brass Block) 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 over tighten and crack the new handle



10.7 Solenoid Valve Replacement

10.7.1 Replacing the Solenoid Coil

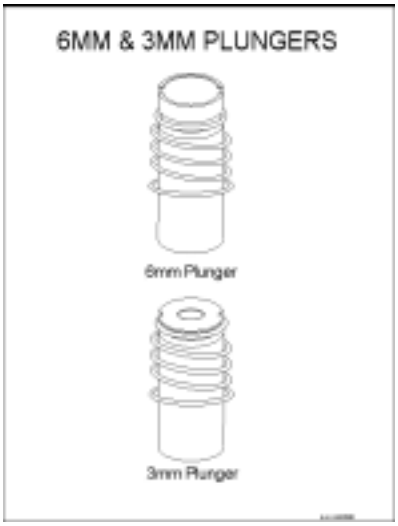
Unplug the unit from the wall outlet
Remove the Outer Cabinet
Remove the screw holding the connection box to the Solenoid Coil
Unplug the connection box
Using a ¾ inch wrench loosen the retaining nut holding the Solenoid Coil then remove the Solenoid Coil.
Using a small screwdriver pry the connection box apart and inspect to make sure the wires and connectors are tight and in position. Correct any problem connections then 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.



ITEM	PART NO.	DESCRIPTION
1	01810908	MAGNETIC SOLENOID NUT
2	01810907 01910102	MAGNETIC SOLENOID 110 VOLTS/8 WATTS(PRE 1991) MAGNETIC SOLENOID 12VOLT/ 10 WATTS(1991 & ON)
3	01810910	MAGNETIC SOLENOID GASKET
4	01810909	MAGNETIC SOLENOID WIRE CONNECTOR
5	01810903 01810904	PLUNGER VALVE 3MM EXHAUST & AIR OUTLET VALVE PLUNGER VALVE 6MM FILL VALVE
6,7	01810103 01810101	WATER FILL VALVE ASSEMBLY COMPLETE(6MM) AIR OUTLET & EXHAUST VALVE ASSY. COMPLETE(3MM)

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 ¾ inch wrench to loosen the retaining nut
Remove the Plunger Assembly using a 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.
Clean any dirt or debris from the valve base
Using compressed air blow out both the incoming and outgoing passage ways in the base
Inspect the valve base for damage.
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.
Install the new Plunger Assembly and tighten down with a 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, then 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, then 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 SSR to overheat and burn out

Reinstall the SSR the way it 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 over tighten, 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 ¾ of the amount of water that the Chamber would normally be filled with
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 over tighten
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, which is engaged by the Closing Device

There are two method of removing the Door Bellows

Method 1 – Compressed air

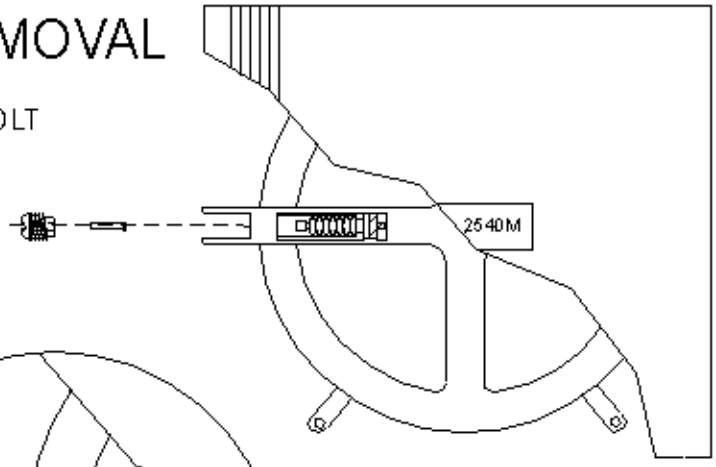
Remove the Brass Housing Bolt from the Door
Locate the hole on the face of the Door that leads to the bellows cavity
Block the opening in the side of the Door where the Housing Bolt was removed with a thick book or block of wood. Care should be taken because the Bellows Assembly will be projected with 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 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 Brass Housing
Install the Brass Housing Bolt on to the front of the Housing
Insert the assembly into the Door
Tighten down the Housing Bolt, it needs only to be snug.

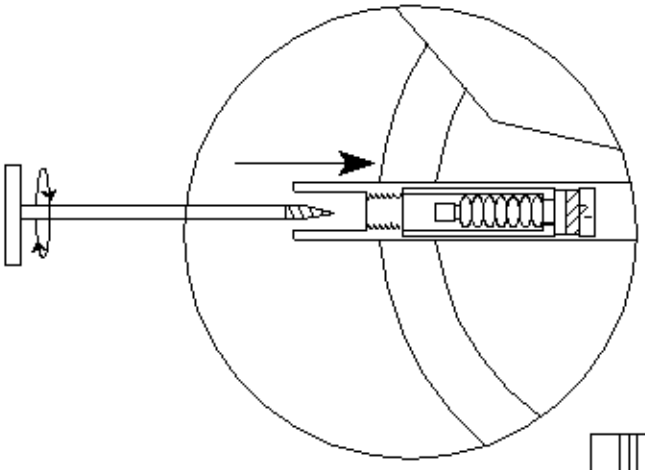
Method 2 – Extraction

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 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 Brass Housing
Install the Brass Housing Bolt on to the front of the Housing
Insert the assembly into the Door
Tighten down the Housing Bolt, it needs only to be snug.

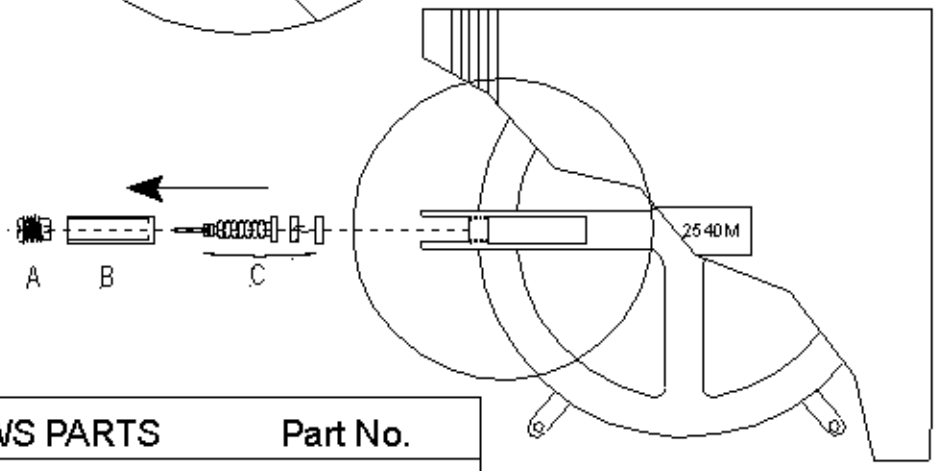
BELLOWS REMOVAL

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 - BELLOWS BOLT	CT245010
B - BELLOWS HOUSING	CT241010
C - BELLOWS KIT (INCLUDES BELLOWS, PIN, BRASS BUSHING & WASHER)	CT241111

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 customers 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 procedure and the Chamber Assembly must then 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 then 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 dipswitch # 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 then 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
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, then 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, then 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 then remove the rubber feet from the old pump bracket and attach them to the new pump, then mount the new pump using the original mounting holes and screws.
Connect the silicone tubing observing the directional arrows. In, from the HEPA Filter is typically on top and out, 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 ¾ 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, being 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 ¾ 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 Ajunc2 Board
    Unplug the green ground wire
    Remove the On / Off Switch from the Front Console
Note the location of and then unplug any connectors plugged into the Ajunc2 Board
Remove solider from the two connection posts, of the Power Transistor, on the front of the Ajunc2 Board
Remove the Ajunc2 Board from the Electronic Box
    The Ajunc2 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 Ajunc2 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 Ajunc2 Board into the Electronic Box using either screws or push on connectors
Solider the two connection posts of the Power Transistor protruding through the front of the Ajunc2 Board
Replug all the connectors into there proper locations on the Ajunc2 Board
Reinstall the Front Console
    Connect the large ribbon cable to the Ajunc2 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 then 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
Reinstall the Ajunc Board into the Electronic Box using either screws or push on connectors
Replug all the connectors into there 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 Ajunc2 Board
    Unplug the green ground wire
    Remove the On / Off Switch from the Front Console
Note the location of and then unplug any connectors plugged into the Ajunc2 Board
Remove solider from the two connection posts, of the Power Transistor, on the front of the Ajunc2 Board
Remove the Ajunc2 Board from the Electronic Box
    The Ajunc2 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 Ajunc2 Board
If you are replacing the Power Transistor then 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 Ajunc2 Board into the Electronic Box using either screws or push on connectors

Solider the two connection posts of the Power Transistor protruding through the front of the Ajunc2 Board

Replug all the connectors into there proper locations on the Ajunc2 Board

Reinstall the Front Console

Connect the large ribbon cable to the Ajunc2 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 then remove the five nuts and one brass post holding the Keypad and Digital Predg Board together. Then 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) then 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, so 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 customers 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 procedure and the Chamber/Door Assembly must then 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 lead removed earlier

10.23 Fuse and Fuse Holder Replacement

10.23.1 Fuse Replacement

Unplug the autoclave
Insert a flat blade screw driver into the Fuse Cap
Press in and twist ¼ 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 (¼ x 1 ¼) and a gray Fuse Cap

10.23.2 Fuse Holder Replacement

Unplug the autoclave
Sip 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 screw 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 on to the back of the Circuit Breaker, making sure they are in the same position as before

11 Component Function in the Autoclave

11.1 Safety Thermostat

There are two safety thermostats installed on the autoclave. One is called the **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 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 **Safety Thermostat** is an automatically resetting device. It is designed to protect against overheating should the external temperature of the Chamber reach between 180 and 200 deg C, during the dry cycle.

The device itself consists of a contact box located next to the in coming power at the back of the machine and a sensing probe located in the lower channel of the rear most 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, 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 Safety Thermostat is wired into the Microprocessor and the Microprocessor uses this information only in controlling the heaters during the Dry Cycle. In addition, this connection to the Microprocessor allows the Microprocessor to use the information from the Safety Thermostat to control the autoclave in another way. This would involve the detection of Low Water. The Low Water message is displayed and the cycle aborted, only when the Safety Thermostat detects an overheating of the Chamber **and** the tip of the Water Sensing Electrode is no longer covered by the water in the Chamber

11.2 Cut-Out Thermostat

There are two safety thermostats installed on the autoclave. One is called the **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 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 – <u>DO NOT</u> try to recalibrate these devices, if broken they should be replaced *****

The **Cut-Out Thermostat** is a manual 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 in coming power at the back of the machine and a sensing probe located in the upper channel of the rear most 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, then 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 then press in the red reset button at the back of the machine. It maybe necessary in some cases to use a pencil point or similar object to completely push in the reset button. When pushed in the button is not designed to stay in, however a small click will be detected

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 then 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 273^0 But with the Air Jet blocked off, just as it would get if was not cleaned, the autoclave would run and the pressure may reach 30 psi, but the temperature would only reach about 260^0F. This temperature is 13^0 below the programmed sterilization temperature. The cycle would fail as well as any spore testing that was done.

It is vitally 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. That 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 through out the Chamber. If the Air Jet were to shut down and not allow this purging then 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 ¼ and ½ 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 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 Safety Thermostat. If the tip of the Water Sensor has become exposed and the Safety Thermostat detects an overheating of the Chamber, the cycle is then 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 Safety Thermostat. If the tip of the Water Sensor has become exposed and the Safety Thermostat detects an overheating of the Chamber, the cycle is then aborted and a **LOW WATER** message is displayed.

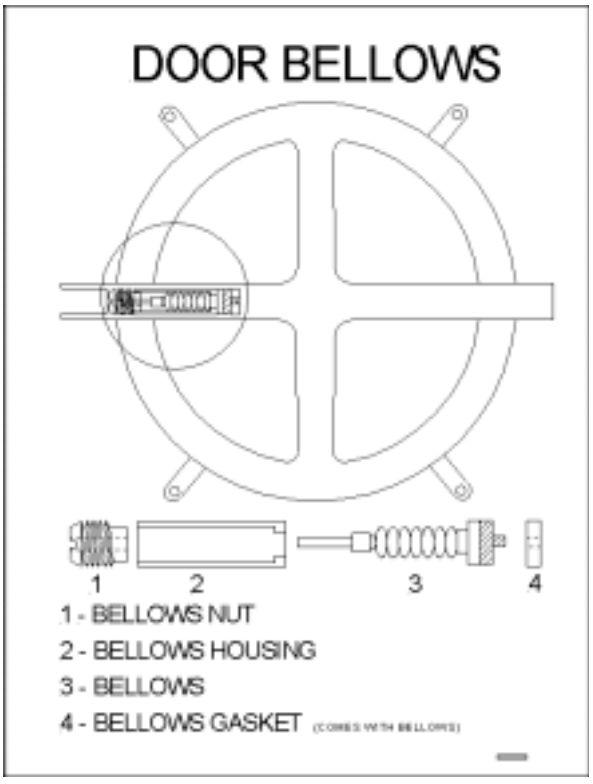
11.5 Door Bellows

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:

The Bellows Housing Bolt
The Bellows Housing
The Bellows Locking Pin
The Silicone Bellows
The Brass Bushing
The 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, in 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 to the rear of the Water Reservoir.

This Air Outlet Valve has several different functions.

1 – 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.

2 – 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 ^{0}F the Air Outlet Valve closes and any remaining air finishes exiting through the Air Jet

3 – 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.

4 – The Air Outlet Valve will open at the end of the **Exhaust phase** to release the final 3 pounds of steam pressure.

5 – 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 reading as well as all error messages.

A typical Printer tape will look like this:

```
AUTOCLAVE NO:1
LOAD NO:014
OPERATOR:
O.K.
D24 193°F 00P
D21 220°F 00P
E20 251°F 02P
S20 273°F 31P
S19 273°F 30P
S18 273°F 30P
S17 273°F 31P
S16 273°F 30P
S15 273°F 31P
S14 273°F 31P
S13 273°F 31P
H12 268°F 28P
H08 231°F 10P
H04 137°F 00P
H00 071°F 00P
MN  TEMP  PRES
DRY :05min
TIME:07min
TEMP:273°F
PROG:PKG
TIME:16:17:02
DATE:01:02:93

Version:T93N6
```

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

Then 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.

Then 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 shortened 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

And 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

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.