
ATIE MEDICAL INDUSTRIES

PS-140 PLASMA STERILIZER

SERVICE GUIDE



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Chapter one

About this Service Guide

This manual is provided to give you the necessary information for the maintenance and repair of the PS-140 machine.

This device is designed in a way to automatically display messages indicating its potential defects. These messages and the analysis of the parameters mentioned in this manual will help us and you to better diagnose and resolve possible defects.

This manual will introduce you to the device's subsections and will show you what bugs may occur in each sub-section and how these defects can be detected. Also, in some cases, it will represent you the ways to perform the necessary repairs.

If You Have Question?

Please call us if you have any question about the device. the customer service phone number is on the first page.

Chapter Two

Safety Information

This is so important for us and it is our primary concern that you are safe when you are using PS-140. This chapter presents information on safety using this device. You must read and follow the safety information. You must understand them before you start to operate the sterilizer.

Please pay attention to all the warnings, all the cautions, and notes in this user's guide. These are for your safety and to ensure that you receive the most benefit from the safe operation of this device.

Personal Safety Information

**WARNING! HYDROGEN PEROXIDE IS CORROSIVE**

Hydrogen peroxide is corrosive to skin, eyes, nose, throat, lungs, and gastrointestinal tract and to all the body. Please always wear latex PVC (vinyl), or nitrile gloves while you loading a cartridge. Or when you remove the used cartridge. Please always wear the gloves when you remove the items in a load of a canceled cycle. We considered a safe-mode cycle for canceled cycles. But if you cancel the safe-mode cycle or the load show any visible moisture or liquid, that might be hydrogen peroxide. So please be careful when this happened.

**WARNING! HYDROGEN PEROXIDE IS AN OXIDIZER**

Hydrogen peroxide is an oxidizer. So avoid allowing hydrogen peroxide to contact any organic material, including paper, cotton, wood, any oil, lubricants. The hydrogen peroxide is a strong oxidizer and it can react with organic materials, it is not flammable itself, but it can be the cause of fire or ignition.

**WARNING! RISK OF EYE INJURY**

If hydrogen peroxide directly contacts with eyes, it can cause irreversible tissue damage.

If contact with eyes occurs, immediately flush with a large amount of water and consult with a physician immediately.

**WARNING! RISK OF SKIN INJURY**

If hydrogen peroxide directly contacts with skin, it can cause severe irritation. If skin contact occurs, immediately flush with large amounts of water. If symptoms are severe or persist, consult a physician immediately.



WARNING! RISK OF RESPIRATORY IRRITATION

Inhalation of hydrogen peroxide must or vapor can cause severe irritation of lungs, throat, and nose. If inhalation occurs, move to fresh air. Never breathe the air upon the opened cartridge. Consult a physician immediately.



WARNING! CONCENTRATED HYDROGEN PEROXIDE IS TOXIC

Ingestion or drinking hydrogen peroxide may be life-threatening. If swallowed, drink plenty of water immediately to dilute. Do not induce vomiting. Consult a physician immediately.



WARNING! HOT STERILIZATION SURFACES

At the end of the cycle, the interior of the sterilizer, the chamber, may be hot. Do not touch inside the chamber with bare or gloved hands. Allow the sterilizer to cool before touching interior surfaces.



CAUTION! AVOID EXPOSURE TO ULTRAVIOLET LIGHT

There is a sight glass on the door of the device in some models. Do not stare at the chamber through sight glass during the plasma stage.

Personal Protective Equipment



CAUTION: RISK OF HYDROGEN PEROXIDE CONTACT

Always wear latex, PVC (vinyl), or nitrile gloves whenever handling a cartridge. Or when a cycle has been canceled and also the safe-mode cycle has been canceled wear gloves to remove the items from the chamber.

Device Safety



WARNING! RISK OF INJURY OR DAMAGE TO STERILIZER

The PS140- Plasma Sterilizer should not be used stacked with other equipment.



CAUTION: RISK OF DAMAGE TO LOAD

Metal objects must not come into contact with the chamber walls, the door, or the electrode. Contact with the walls, door or electrode could damage the sterilizer or the metal object and load. It may cause to a fire inside the chamber. So please be careful during the loading.

**WARNING! YOU MUST KNOW WHAT THIS DEVICE DO AND WHAT YOU CAN PROCESS**

Before using this machine, it is important that you know how to process items with this machine. You should know the effects of this device on your items. Please read the instruction before use. Please follow the device manufacturers' instructions for their products. There is a list in this guide that tells you what is safe to be sterilized in this device and what shouldn't be processed with this device. Do not replace this instruction with other medical device manufacturers' instructions. If you have a question, or if you are in doubt about the materials in your devices, contact the medical device manufacturer. Then if it can be sterile in this device, then process the device in this sterilizer.

**CAUTION! RISK OF VIOLATING OF WARRANTY**

Improper processing may limit our liability for damage to processed instruments.

Improper processing may also violate your instrument warranty.

**CAUTION! RISK OF DAMAGE TO LOAD - METAL OBJECT**

Please be careful when you load metal objects in the chamber. Metal objects must not come into contact with the chamber walls, the doors, or the electrode. Contact with the walls, doors or electrode could damage the sterilizer itself or the metal objects. It also could start to a fire inside the chamber. So please be careful during loading.

**CAUTION! RISK OF DAMAGE TO LOAD - VENTING CAPS**

You should take care about venting caps, these caps should be placed according to the manufacturer's instructions. You should confirm that. Venting caps are intended to prevent damage to flexible scopes that are being exposed to a vacuum, regardless of the sterile agent that used.

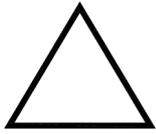
**CAUTION! RISK OF DAMAGE TO LOAD - IMMERSION CAPS**

You must remove the water-resistant immersion cap (if present) prior to processing in the sterilizer. If the immersion cap is not removed prior to processing in the PS140- sterilizer, it will damage the flexible scope due to the inability to properly vent.

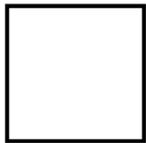
**CAUTION: RISK OF INAPPROPRIATE LOAD**

If you want to process flexible endoscope in this sterilizer, you must read, understand and follow the medical device manufacturer's instruction for use the particular scope into the process. For more information please contact the medical device's manufacturer.

Warnings, Cautions, and Notes



Warnings and Cautions are accompanied by symbols surrounded by a triangle or a square and are printed in the text in bold. Warnings indicate events or conditions that can result in serious injury or death. Cautions indicate events or condition that can result in severe damage to the equipment.



Notes have a checkmark in front of the word “Note.” Notes highlight specific information about proper use and maintenance of the PS140-Plasma Sterilizer.

Symbols Used on the device and in This Guide



Hot surface present
Do not touch without protection



Hazardous / corrosive chemical present.
Use personal protective equipment.



Oxidizing chemical present
Avoid exposure, contact, or ingestion.
Avoid organic material, oils, and flammable material.
Use personal protective equipment



Toxic chemical present.
Avoid exposure, contact or ingestion.



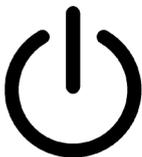
Ultraviolet (UV) light hazard.
Do not look at sight glass of the device.



High voltage hazard.
Electrical Shock Hazard



Hand Pinching Warning



On / Off
power switch



door up (open) switch



door down (close) switch



Emergency Stop switch



Earth Connection



Alternating Current

Chapter Three

Introduction

The PS-140 sterilization device is designed for use in hospitals and medical centers and for sterilization of medical equipment. This machine uses hydrogen peroxide as disinfectant. The purity of this substance, given as input to the device, is 50% by weight. The main disinfectant of this device is also hydrogen peroxide and at the end of the sterilization cycle, a plasma will be applied to the chamber. This plasma decomposes the remaining hydrogen peroxide inside the chamber and onto the equipment. Also, the presence of ultraviolet light and high energy of the plasma in the chamber of this device will be a factor in the elimination of microorganisms.

This section describes the function of the machine.

Functionality:

The sterilization process in the PS-140 plasma sterilizer starts as follows:

- First, after turning on the device, the device will be allowed to warm up for the first time on the day when the device is cold.
- This heating takes about 45 minutes.
- After the device is warmed up, the operator will be allowed to start
- The items to be sterilizer should be ready by the operator of the machine and in accordance with the conditions in the user manual should be placed in the chamber.
- The chamber's door closes.
- The operator selects the type of cycle.
- The operator loads the hydrogen peroxide cartridge.
- With the approval of the operator, the cycle begins.

After the start of the cycle, the process will be as the following:

- The pressure of the device's chamber is reduced by the vacuum unit. At this stage, hydrogen peroxide is drawn out of the cartridge for a half-cycle and then poured into the measuring container.
- After measurement, this hydrogen peroxide is transferred to the condenser chamber.
- At this stage, hydrogen peroxide is heated, and the condenser pressure is adjusted by a specific pattern to accomplish the condensation process. This step takes about 10 minutes for a short cycle and lasts about 25 minutes for a long cycle.

- After the condensation process, the chamber's pressure is reduced and the it is prepared for spraying.
- As the pressure in the chamber decreases, the condenser pressure is increased and the condenser is prepared for injection.
- Once the chamber and condenser's pressure reaches to the set values, the machine will enter the injection and diffusion phase. This stage takes place in two phases by itself, and at two different pressures; and all of these takes about 10 minutes.
- All the above steps are repeated one more time.
- At the end, the chamber will be vacuumed by the vacuum unit for the last time until very low pressures, and then about 3 to 5 minutes, the plasma state will be applied to the device chamber.
- At the end of the plasma, the clean air filtered by the HEPA filter will be injected into the chamber and the it will come to atmospheric pressure.

• Note that all the routines listed and described in this service manual must be carried out by an authorized representative of the company, and repair, service and manipulation of the system in any way outside the user's manual will invalidate the warranty.

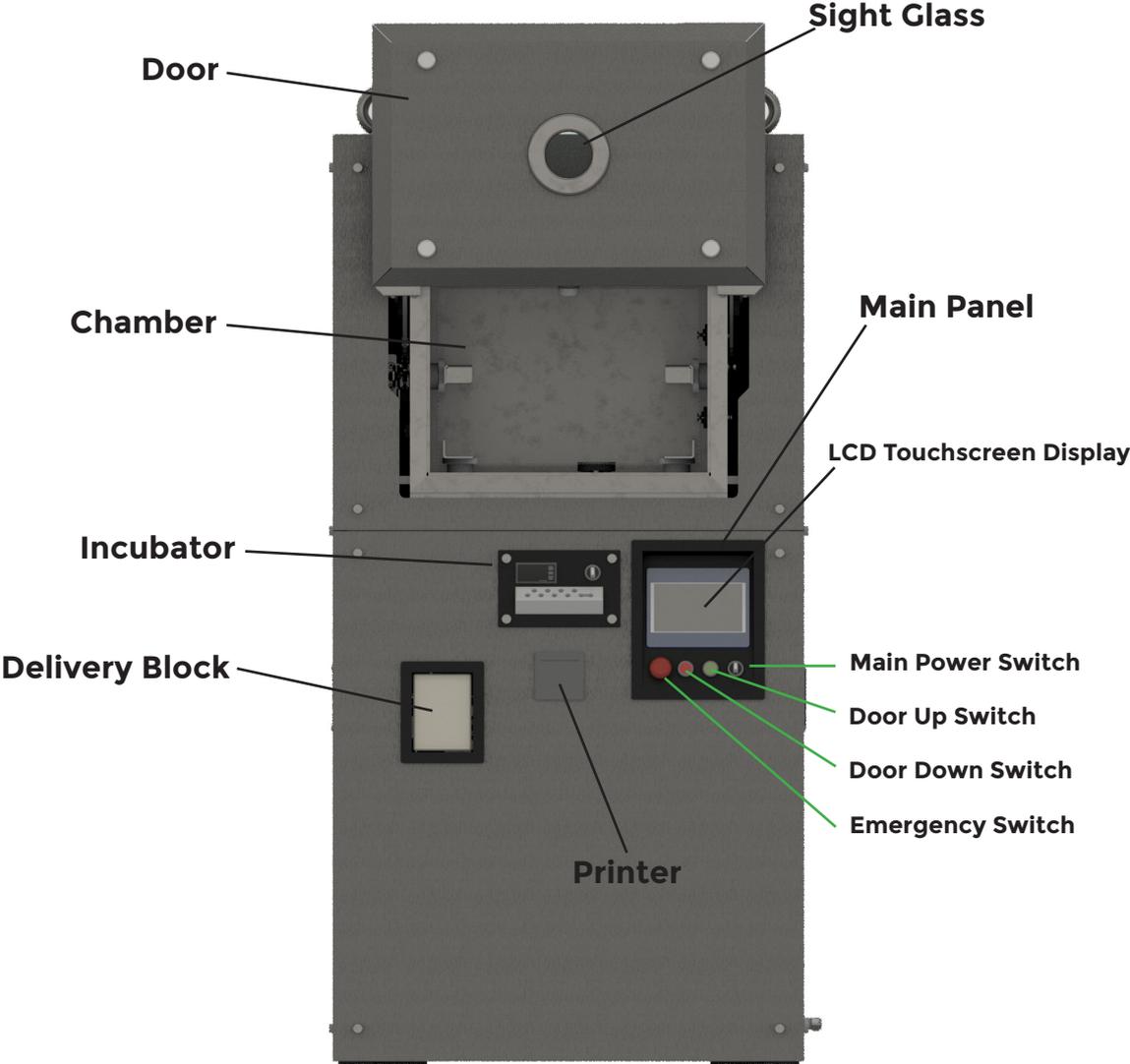
Chapter four

Device Overview

In this service guide various parts of the machine, along with their possible defects, are reviewed.

You find these things on the device when you are processing a cycle.

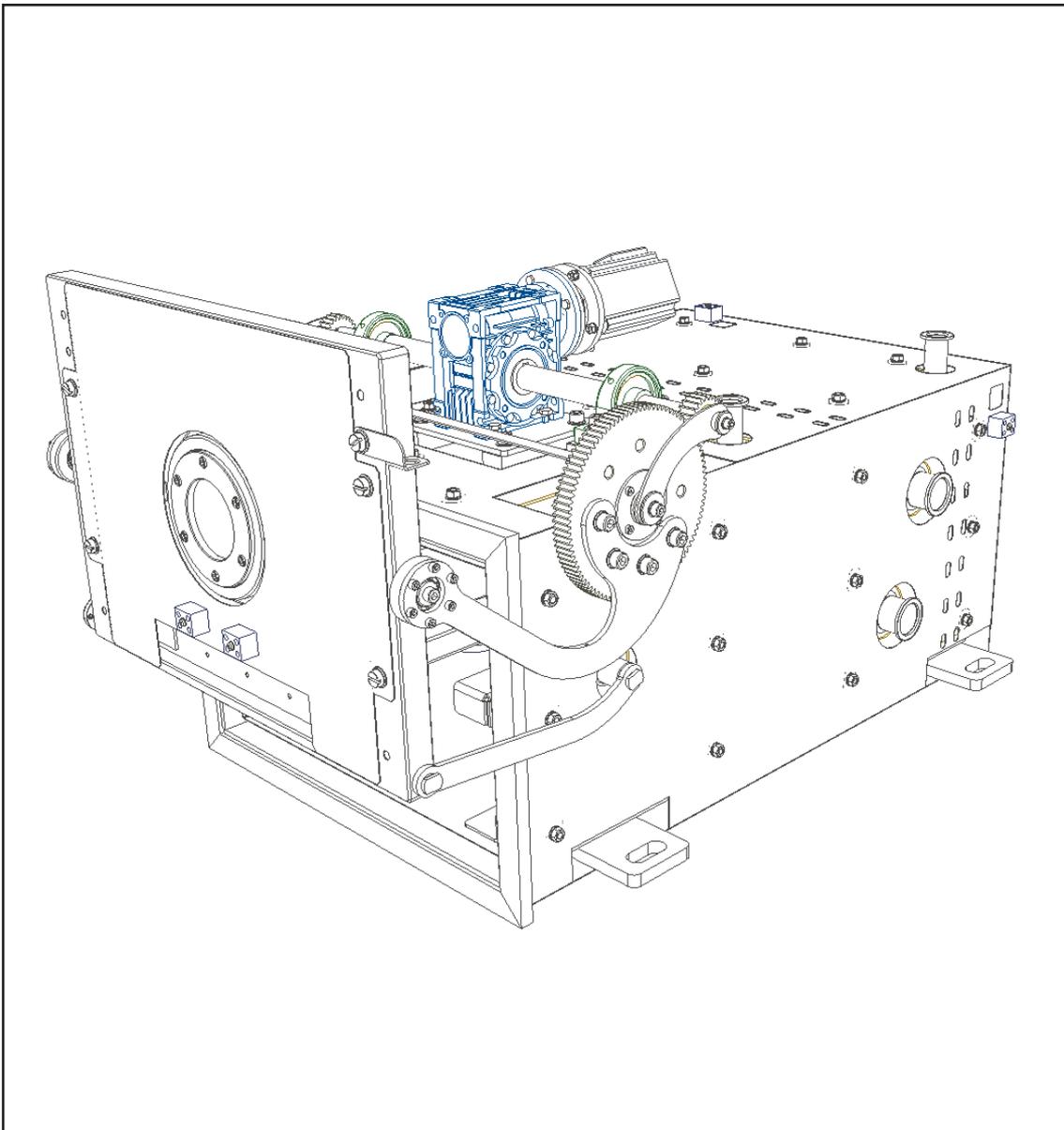
- 1- Cartridge
- 2- Delivery block
- 3- Chamber
- 4- Door
- 5- Sight glass
- 6- Printer
- 7- Incubator
- 8- LCD touchscreen display
- 9- Main Power Switch / (On / Off Switch)
- 10- Emergency stop switch
- 11- Door up switch
- 12- Door down switch



Chamber and Doors:

The door of the machine is connected to the device by a pair of arms to the gear and gearbox, and the device door moves vertically to open and close the chamber's front side. The door is embedded with an O-ring for better sealing of the chamber and reaching to the lowest possible vacuum pressures. The device chamber on its walls has heaters that are covered with thermal insulation and heat the chamber in the range of 55 to 65 degrees Celsius.

Each of these heaters, in addition to the thermocouple for temperature sensing, has a 120 ° thermal thermostat in its input path so as not to allow the temperature of the items to rise above 120 ° C in emergency conditions if there is any error.



Possible Flaws:

The door is not opened:

-There is a problem with the gearbox and there is no transfer of power from the servo motor to the arms, which requires repair or replacement of the gearbox.

-The servo motor is damaged and needs to be repaired, in which case the door cannot be opened.

-The problem with motor wires or motor drive that may need to be repaired, in this case the door cannot be opened.

Thermocouples of the chamber's heaters may be damaged, in which case the temperature sensor error will appear.

-The thermal fuse may be defective, and the temperature of some points of the chamber may not reach to the optimum value; in this case the error will be appeared indicating the disability to reach the desired temperature.

-The over-temperature error is also considered in addition to the thermal fuse to display an error if the temperature exceeds the tolerable temperature for the heater.

-The door of the device is equipped with an optical sensor in its lower area which detects the presence of any external object on the door movement path and an obstruction error appears if ant thing is detected.

-Displacement of the door O-ring from its place which will result in not decreasing the chamber's pressure; and the door closing error will appear.

-The machine door at the end of its course has a capacitive sensor and a mechanical micro switch, which declares that the door moves at the end of its course in any condition to the central control unit and prevents damage to the device cover and door system.

-The chamber has two feethrough connections for high voltage transmission to the chamber and electrodes for plasma formation.

Pneumatic Unit:

The unit consists of electro-pneumatic valves fitted in the electrical control panel and an air compressor with a capacity of 10 liters, which is responsible for providing the pressure for the pneumatic actuators of the system.

The compressor has a pressure regulator set up to 6-bar and has an electric switch to confirm the pressure that will send the confirmation signal to the central control unit after reaching the desired pressure.

The machine has 6 electro-pneumatic valves, which activates six pneumatic actuators. These six operators are:

- 1- Vacuum valve
- 2- H2O2 Valve
- 3- Orifice Valve
- 4- Vent Valve
- 5- Delivery Front / Back
- 6- Delivery UP / Down

Possible Flaws:

One of the failures that can occur mainly in electro-pneumatic valves is the penetration of the element and foreign particles into the valve and disrupts the proper functioning of the valve.

In this case, the valve will not be able to open and close its Pneumatic Operator. Each of the pneumatic operators which fail in their normal activity will display the corresponding error on the monitor.

Vacuum valve:

In this case, the chamber's vacuum process will not occur and a vacuum error will appear on the monitor.

Vent Valve:

In this case, the pressure inside the chamber will not reach the ambient value and the vent problem and vent error will appear.

If the system is not able to close this valve, the chamber vacuum process will be disturbed and a vacuum error may appear.

Also, if the vent valve is not closed, the error of not closing the door may appear on the monitor at the beginning of the cycle.

H2O2 and Orifice valves :

Failure to close the H2O2 and Orifice valves will be detected in the vacuum test stage of the device and their opening failure will be detected in the condensation process.

The breaking down of electrical solenoids, have the same consequences as pneumatic valves breakdowns and have similar errors. To find out whether the valve defect is from the solenoids or the electro-pneumatic valve itself, we can manually trigger the valve and if the actuator is activated, the probability of the solenoid deflection will be increased. You can also isolate the solenoid from the circuit and measure the resistance of the bobbin, and if there is an acceptable resistance, the correctness of the bobbin's performance will be ensured.

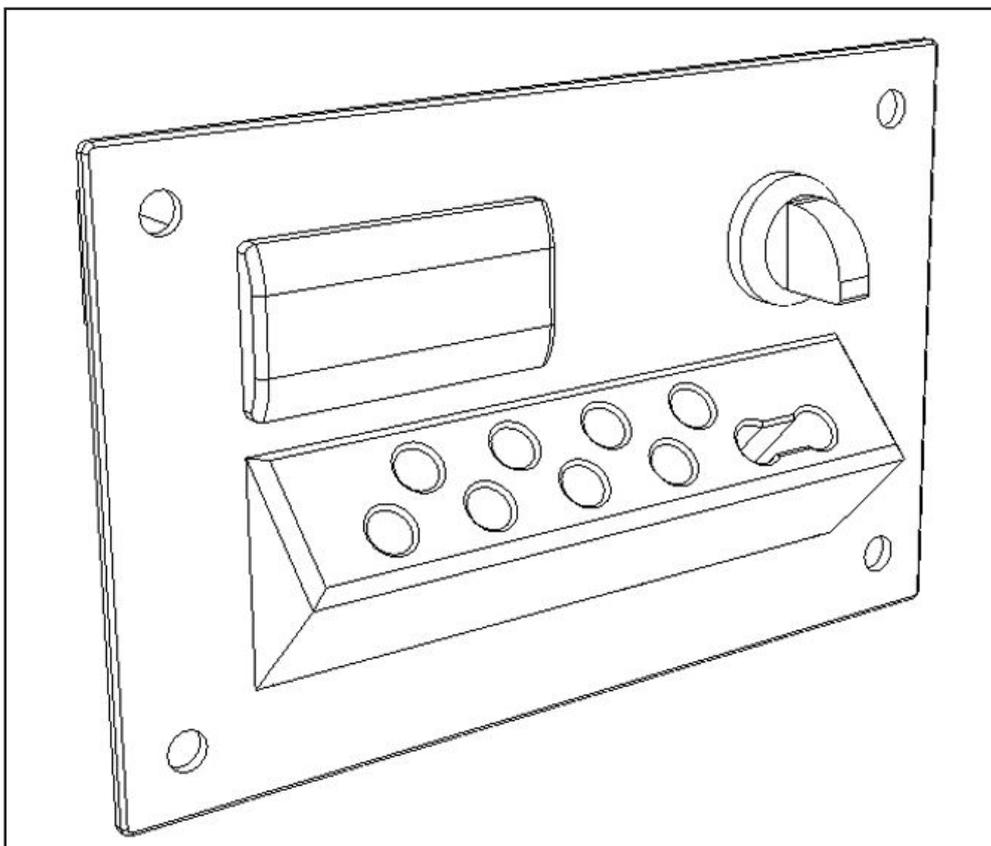
Air Compressor:

In the air compressor, there are two electric actuators for setting the pressure in the range safely, if there is a mistake in setting these operators, that are made by two adjustable screws in the pressure switch, the pressure confirmation signal will not be sent to the control unit and the compressor unit error will appear.

Incubator

This unit is located on the front of the machine and used in order to incubate the biological tests on the device. This unit has a separate input power from the central control unit, so that if the device is turned off, the unit will be able to remain active independently for a longer period of time.

This unit has a 0.5 ampere glass fuse, in the input power and also an 80 ° C thermostat to control the temperature of the unit. In case of failure of each of these fuses, the temperature of the unit cannot increase to 56 degrees which has been set before. With checking the temperature controller which is installed on the unit to monitor the temperature of the unit, any possible failure in this unit is easily detectable.



Printer:

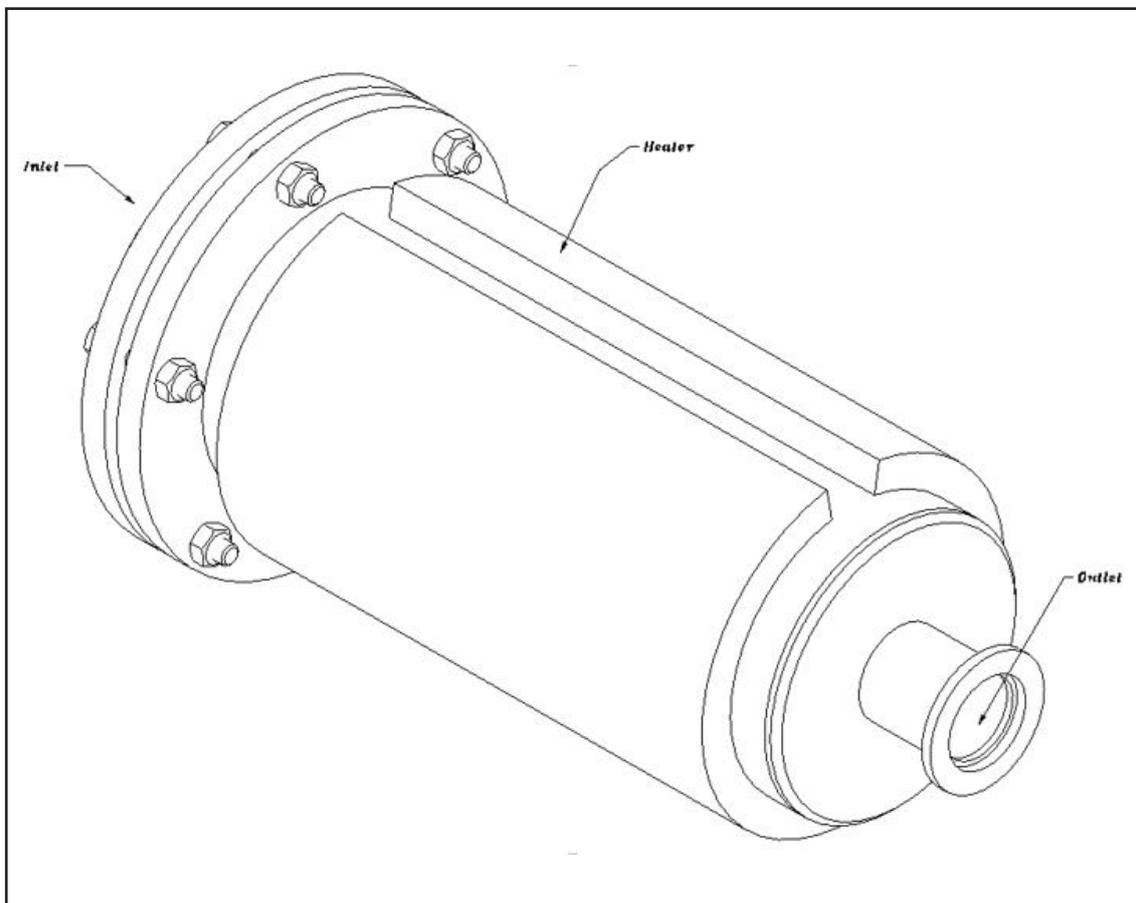
The printer will print the parameters of each cycle at the end of the process, and when it is run out of paper, the lamp will light up on the printer with the flashing pattern. The changing routine of paper is mentioned in the user manual.

Exhaust:

This equipment is to neutralize the acidic hydrogen peroxide vapor in the vacuum pump path, which will perform a neutralization of hydrogen peroxide vapor by a catalytic process. This equipment will be heated by a thermal element to 100 ° C and its thermal analogue signal will be sent to the central control unit by a thermocouple; and the temperature control function will be done in this way. This equipment is fitted with a special vacuum coupling and with a clamp in the vacuum path, and it is natural that any leakage will cause the chamber to not reach to the required vacuum. Therefore, checking the clamps connected to them and their firmness is essential for the isolation of the system.

If the unit's thermocouple is damaged, a fault that the temperature sensor of the equipment is faulty will appear on the monitor.

Also, if the relay for turning on the heat exchanger of this unit is damaged, the temperature will not reach the desired level and the error associated with the cooling of the exhaust will appear on the control monitor.

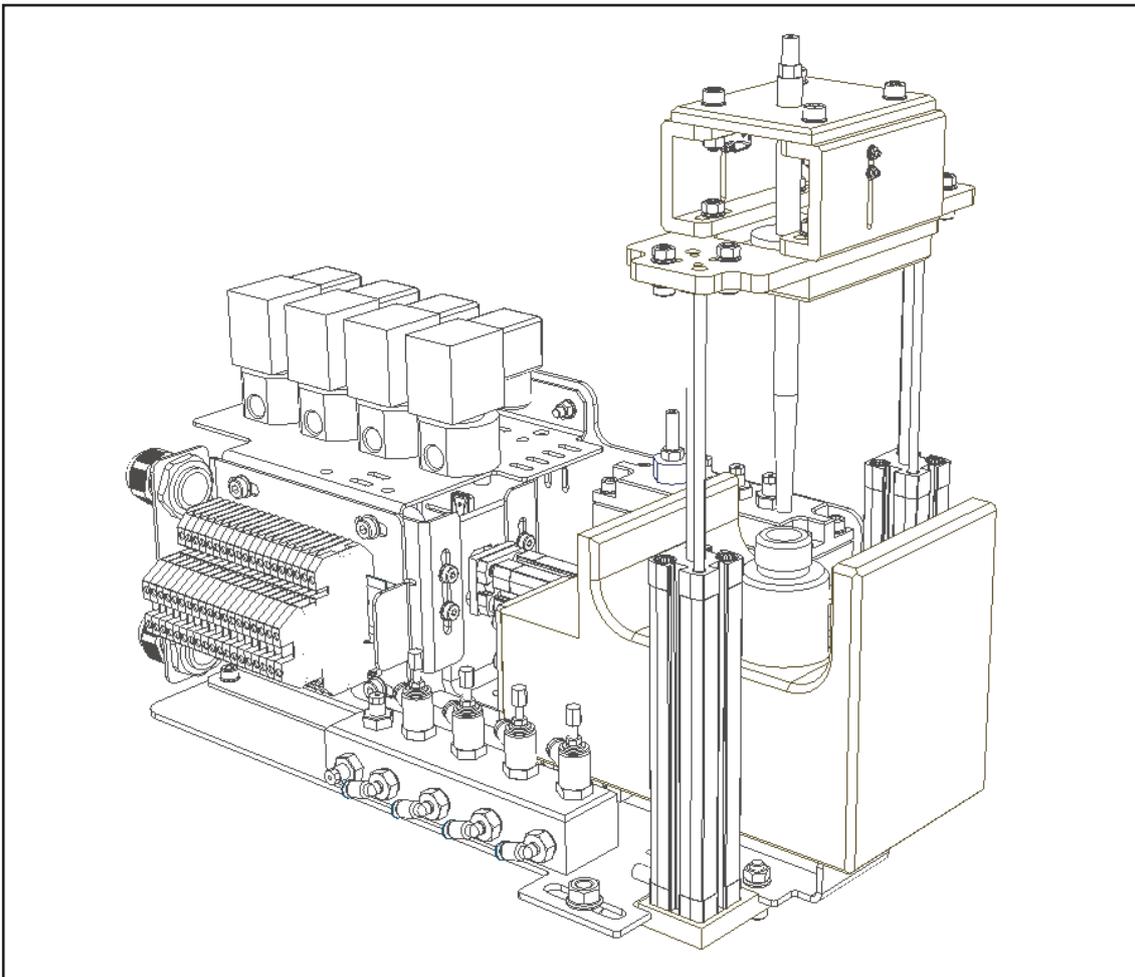


Delivery Section:

The delivery sub-section has a main frame, a delivery block, a pneumatic cylinder, a pneumatic block, a hydrogen peroxide 4-way, a measuring container, an aeration valve, a vacuum valve, a hydrogen peroxide valve, and a condensation valve.

The movement of the unit's pneumatic cylinders is controlled by the magnetic sensors mounted at the end of each cylinder and the related messages are sent to the central control unit. In this part of the device, the main block has the front / rear movement, and there's also a nozzle with two parallel cylinders which controls the up/down movements. The nozzle enters the cartridge and will be the hydrogen peroxide path. If the user does not open the cartridge's lid, the nozzle hits the bottle cap, and since the force of the piston is transmitted through a spring to the nozzle, the spring will be compressed and the sensor embedded on top of the nozzle is stimulated and this will be sent to the central controller.

Front / rear movement is bound by a linear guide. At the end of the front / rear pneumatic cylinder, the piston force will be pushed by the spring to the block. This spring is compressed if the spring is pressed but the block does not move. This compression causes the hand-grip sensor to be stimulated. When the operator's hand is placed between the block and the body of the device, this sensor is stimulated and does not allow more pressure on the operator's hand. Within the main block, there is a pair of optical sensors that detect the presence of the cartridge.



Possible Flaws:

This section may be subject to the following problems.

1. Pneumatic cylinders do not work properly.
2. Pneumatic connections have leakage.
3. Hydrogen peroxide connections have leakage.
4. The valves of this unit have problems.
5. Optical sensors are broken or not properly adjusted.
6. The magnetic sensors of the open and close position of pneumatic cylinders are broken.
7. Rails and wagons in linear guide have problem.
8. The hydrogen peroxide detector sensor is not properly set.
9. The speed of opening and closing the pneumatic cylinders is not regulated by the corresponding flow controller.

These problems will have the following consequences:

- The hydrogen peroxide sensor has two parts, one is the level gauges that is in the delivery unit and is accessible from there. The other part is inside the electrical control panel of the device and it has the task of measuring the electrical resistance of hydrogen peroxide.

If the level sensor is not set correctly, these problems may occur:

- 1- The device may not use enough hydrogen peroxide in the sterile cycle, and sterilization may not be correct.
- 2- Some hydrogen peroxide may remain in the cartridge at the end of the sterilization cycle.
- 3-The «empty cartridge» message may be incorrectly displayed in the sterile cycle.

-These problems may occur if the part inside the electrical control panel is not properly set up:

- 1-The sensitivity may be set so low that the presence of hydrogen peroxide in the delivery measuring pot is not properly detected.
- 2-The sensitivity may be set too high which may cause to incorrectly detect the low levels of hydrogen peroxide adhered to the measurement levels of the container as the presence of enough hydrogen peroxide.

- Pneumatic cylinders:

If the pneumatic cylinders are faced with a problem, these bugs occur:

- 1- The delivery block may not come out of the cartridge while loading and when the pneumatic actuators are active.
- 2-Noise of air leakage may be heard by activating the pneumatic actuators.
- 3-The compressor may remain permanently on.
- 4- The cartridge's lid error may be incorrectly displayed after loading the cartridge.
- 5- After the cartridge error is displayed incorrectly, the delivery block may come out along the path and get stuck.

- If there is leakage in pneumatic connections:

- 1- The “hiss” sound of the air leakage can be heard continuously or not continuously during the loading of the cartridge,
- 2- It may be possible that even the pneumatic actuators are active, the delivery block not comes out from the device
- 3- A compressor error may be displayed and the machine will not work.

- If the hydrogen peroxide connections have leakage, the following problems may occur:

- 1- Device sensors may not be properly calibrated.
- 2- There may not be vacuum action at the specified time for vacuum, and vacuum failure occurs.
- 3- Leakage may cause hydrogen peroxide loose.
- 4- There may be some problems with the hydrogen peroxide process.
- 5- The cartridge error may be mistakenly displayed.
- 6- The pressure at the injection and diffusion stage may be increased when it should be low.

- If there are problems with the delivery unit valves, these problems will occur:

- 1- Sensors may not be properly calibrated.
- 2- The cartridge error may be mistakenly displayed.
- 3- In the first half of the cycle, all hydrogen peroxide in the cartridge may be transferred to the measuring pot and transferred to the condenser.
- 4- The cycle may not be executed correctly.
- 5- The pressure at the injection and diffusion stage may be increased when it should be low.
- 6- Pressure at the injection and second injection stage may be lower than the desired level.

- There are three optical sensors in this section:

- 1- Cartridge presence sensor
- 2- Sensor for cartridge's lid
- 3- Hand grip sensor

-If there is a problem with the cartridge sensor:

In this case, the presence of the cartridge is not detected in the delivery Block. This will prevent the cartridge from reaching into the device and it will be a result to not progressing the wizard program.

-If there is a problem with the cartridge's or if the sensor is not properly adjusted

- 1- In this case the cartridge door closing error may be displayed, although the cartridge door had been opened open.
- 2- Although the cartridge's may be closed, the sensor may not detect it and cause the nozzle to drop below and do not empty the hydrogen peroxide into the measuring pot of the delivery unit and the empty cartridge error will be displayed.

-Hand-grip sensor:

1- If the hand-grip sensor has not been adjusted correctly, an error for the delivery unit maybe displayed even if there is not any obstacle in the way preventing the delivery block to close.

2- If there is a problem with this sensor, it may not work. And if there is a barrier in the way for closing the delivery block, the sensor will not detect, and the barrier will remain between the delivery block and the body of the machine.

- If the sensors of the delivery cylinders are broken or not properly adjusted, the following may occur:

1- The block may not go out because it is not detected that the nozzle has been risen.

2- The cartridge loading stage may not be progressed to the startup stage after selecting the «confirm and continue» option.

- There is a problem with the Linear guide:

In the event of having problem with the rail and wagon, it may be possible to create undesirable sound while moving the block towards the outside and inside.

- If the speed of opening and closing the pneumatic cylinders is not set, the following may occur:

1- The block may come out quickly and cause an undesirable sound.

2- It is possible that the hydrogen peroxide is discharged into the delivery block as the block enters in the device quickly.

3- The speed may be too high for the up and down movement of the nozzle; so the bottle's lid is difficult to detect.

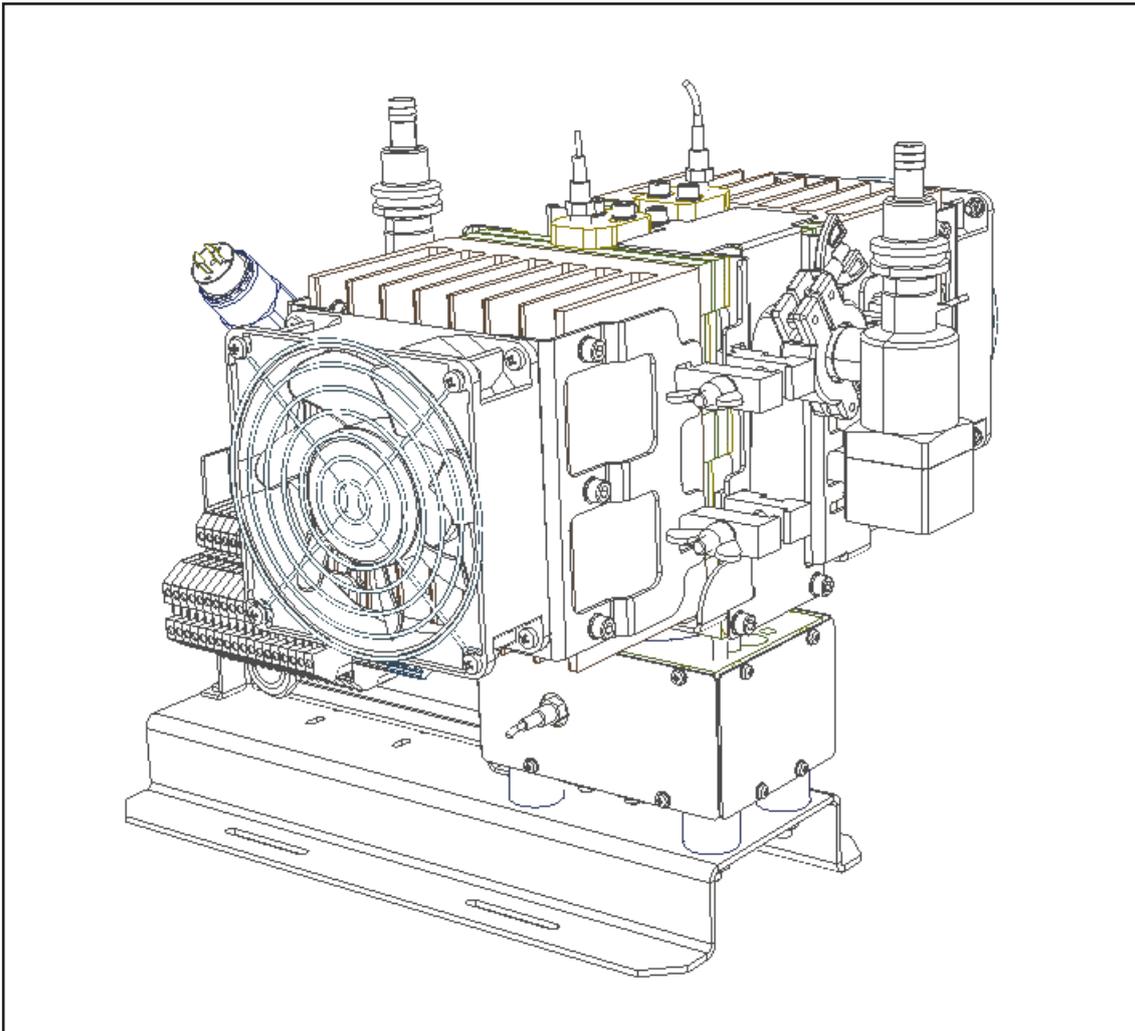
4- The speed may be so low that it is taken out of time to reach the end of the course, in which case the error of the bottle cap might be mistakenly displayed.

Vaporizer Unit:

This part has the function of condensing / evaporating and injecting hydrogen peroxide into the chamber and it consists of the following components:

Hydrogen peroxide container, side plates, main compartment, base plate, pressure sensor, hydrogen peroxide valve connection, condensing valve connection, thermoelectric cooler, temperature sensors, O-rings, heat sinks and fans and electrical terminals.

This part is very important and is in fact it is the main component of the system. If this unit fails, it will directly affect the result of the cycle.



Possible Flaws:

- Problem in the structure

The problem with the structure of this unit is that the body, side plates,- main compartment, hydrogen peroxide container, cannot resist in long period of working in contact with high concentration acid. in cases where the problem is mild, it can be resolved, but if the structural problem is serious, there is no chance of repair, and inevitably, the structure should be replaced.

In order to check the structure of this unit, there is no option but to open and check this section visually.

Generally, it's better to check the unit every 500 cycles once

-Problem with electric elements:

If there is a problem with the pressure sensor:

If the pressure sensor of this section shows the pressure out of the range, the error of pressure sensor number 2 will be displayed. And in this case either the sensor should be replaced or the sensor pins have been incorrectly connected.

Be sure to turn off the device for changing the pressure sensor or changing the pins.

Defective thermocouples:

This part of the device has a total of 4 thermocouples. 2 thermocouples in two side plates, a thermocouple in the hydrogen peroxide container, and a thermocouple for heatsinks

To test the thermocouples, open these thermocouples from the control panel, and then run the short-circuit test.

Also, these thermocouples should not be connected to the device's body. If these two tests show that the thermocouple is working fine, it may be a problem with the thermocouple or from the control board.

If fans do not operate, remove these fans from the terminal and test them separately.

This part of the device has 15 thermoelectric coolers. These components, in total and at a maximum flow rate needs about 59 amps this power is supplied by 12-volts power supplies located on the electrical unit.

To test the functionality of these elements, use the condenser test on the settings page. This sub-routine measures the thermoelectric's current and compares it with the standard value and displays the accuracy of the function with a percentage.

Vacuum Unit

The vacuum unit consists of a main frame (mounted on four wheels), an oil pump, an oil circulation pump, an oil mist filter, a gas ballast valve, Oil hoses, drain valve, and the oil return valve*. (* On some models)

In the device software, a routine has been created on the configuration page, which tests this unit individually.

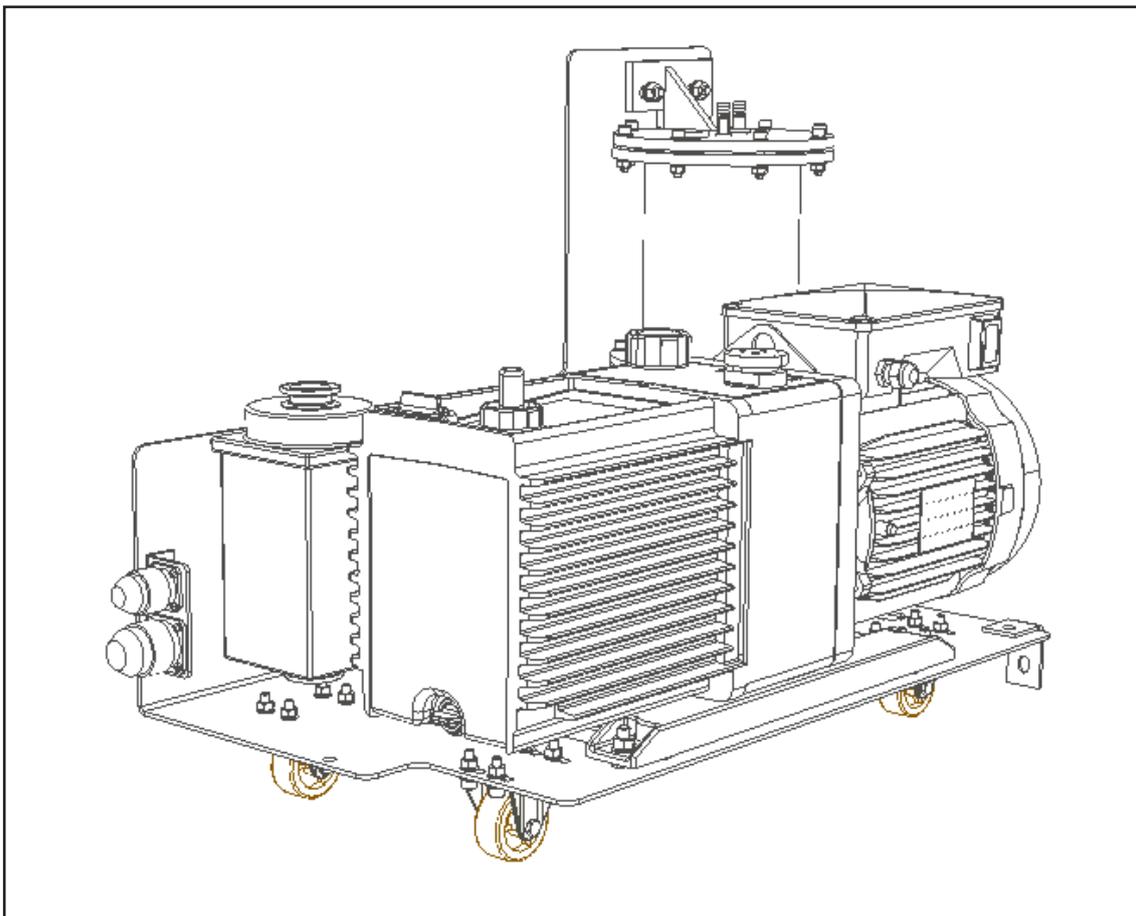
The oil level of the vacuum pump can be seen through the pump sight glass. This oil level should be slightly more than a quarter of the glass of the minimum level specified on the pump when the circulating pump and the vacuum pump are in their on state.

The oil mist filter will be filled up after several cycles and this filter must be eliminated from the oil.(for models of the device that do not have the oil return valve.)

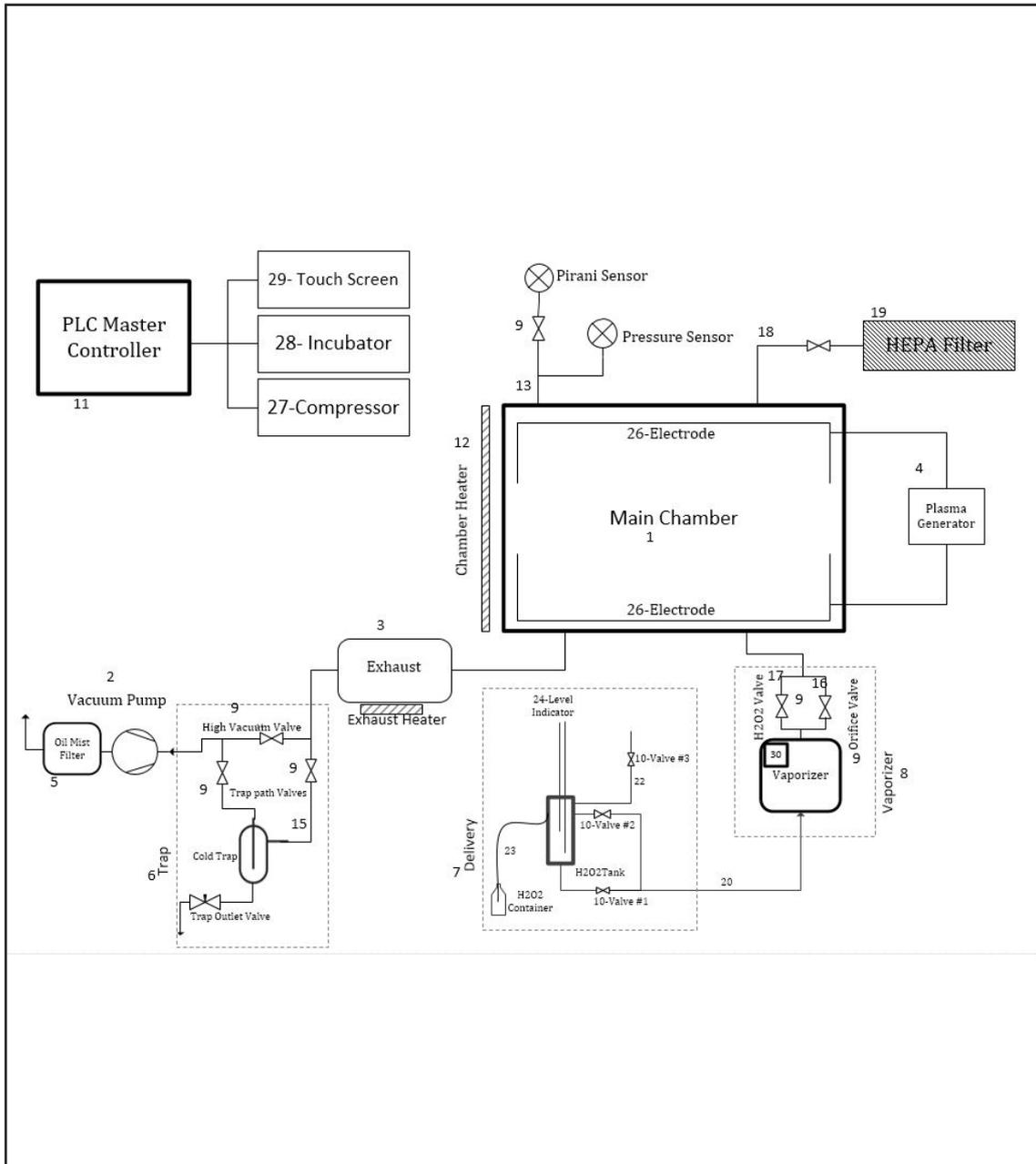
In order to check the oil filter, it is best to check the pump oil flow rate. First open the hose that pours the oil in the pump, which is connected to the top of the vacuum pump, then check the flow rate of the oil by turning on the circulation pump. If the flow is discontinued, the filter must be replaced. The number of cycles each filter can last is about 200 cycles.

It is suggested that the pump oil should be replaced after 500 cycles.

The oil circulation pump is active all the time when the central pump is in operation, and the oil continuously pass through the oil filter and be refined.



The piping system is showed below:



Oil filter of Vaccum Pump:

The filter has a solenoid valve designed to eliminate the moisture collected from the system.

sensing the amount of this accumulated moisture is handled by a level sensor that is embedded in two levels of the filter and informs the central control unit about the minimum and maximum permissible humidity for the system.

Repairs and maintenance of the vacuum unit

Oil Replacement:

To replace the oil, first we have to assure that the vacuum pump and the oil pump are switched off, then we open the air inlet on the top of the filter compartment, and then open the filter drain valve through the control panel and on the manual control page. When the oil is discharging from the oil container, the oil circulation pump should be activated simultaneously with the drain valve to drain the remaining oil inside the pump.

To recharge the oil, while the air drain connection is still open, close the oil drain valve, then the pump outlet can be opened, from which the oil is poured into the vacuum pump and the oil circulation pump you have to activate. Pour the oil into the oil pump until the air outlet reaches above the oil filter compartment. At this time, close this connection, and watch the oil level on the pump's sight glass until the oil level reaches somewhere between minimum and maximum in the sight glass on the pump. At the end, we will re-install the exhaust filter on the pump.

The filter of this unit must be replaced after every 200 cycles. The access to the filter of this set is such that the end of the filter compartment shown in the figure and connected through the 8 screws to the flange of the compartment. Open and replace the filter from the inside of the enclosure with a special opening tool. After changing the filter, wash and clean the lower compartment so the control blades cleaned. it should be noted that the inside of the compartment to the surface of the «low» blade have to be filled with water, then assemble the enclosure. Connect the oil inlet and outlet hoses to the central connection of the filter compartment and the second connection away from the center of the compartment.

Possible Flaws:

- if the oil level is less than the minimum level, the pump will not be able to reduce the pressure of the chamber and a vacuum error will be appeared. In this case, the leakage of oil from the device is probably happened.

- Dirt on filter blades

In this case, the filter will not be able to remove the water and if the moisture discharge in the filter does not occur. After the specified number of cycles, a filter error will appear on the monitor.

-Unpleasant odor of oil

In this case, the exhaust filter is saturated at the vacuum pump outlet and needs to be replaced.

-Checking the Wiring of the Vacuum Unit

Vacuum unit operators include vacuum pump, gas ballast valve, filter control blades (which include low and high blades and connected to a filter with a socket), oil pump, filter drain valve, filter valve. It is done through two sets of vacuum wiring sockets.

-Broken solenoid of Drain valve:

In this case, with not opening the valve, the moisture of the system will be increased and the blade sends the signal continuously and the control unit will display the valve fault error on the monitor.

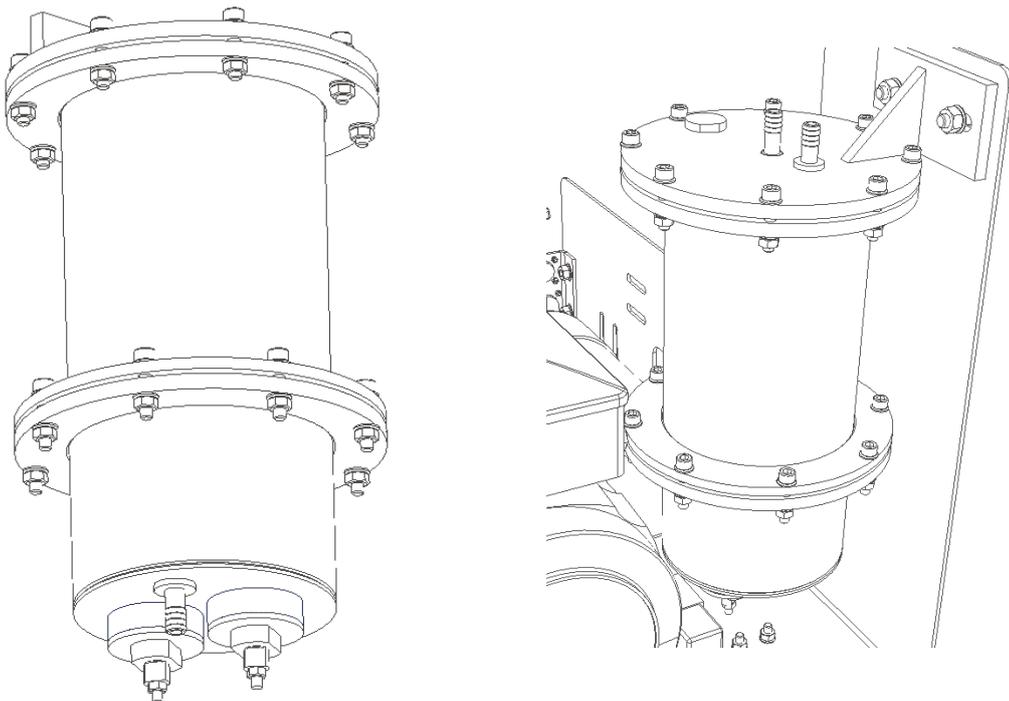
-If there is an error on the monitor that there is a danger of a vacuum unit and a filter

for any reason, such as sticking an external particle in the valve and preventing the valve from opening and closing, or draining the oil system, the device will be unusable until the return to normal service.

-Damage to the vacuum pump

In this condition, the unit will not be able to reduce the reservoir pressure, and a vacuum error will appear until the pump is serviced and returned to normal. Then the error will be disappeared too.

After changing the filter or after a filter service or pump service, you must activate the corresponding option on the device's settings page, turn off the device once and then turn it on, after that the counter of the filter cycles will be zero and the errors will be disappeared.



Chapter five

System Troubleshooting

In order to make it easy to troubleshoot, the software system of the device has predetermined errors, which can result to better services by us with detecting these errors. The software also has a supervisor part, it will observe the whole process to perform its correct performance. And in the event of an error, it prevents the wrong operation of the device.

Below you can see a list of possible errors that may occur in the device.

1	Pressure sensor 1# error
2	Pressure sensor 2# error
3	Pressure sensor 3# error
4	Temperature sensor 1# error
5	Temperature sensor 2# error
6	Temperature sensor 3# error
7	Temperature sensor 4# error
8	Temperature sensor 5# error
9	Temperature sensor 6# error
10	Temperature sensor 7# error
11	Temperature sensor 8# error
12	Temperature sensor 9# error
13	Temperature sensor 10# error
14	Temperature sensor 11# error
15	Temperature sensor 12# error
16	Temperature sensor 13# error
17	Temperature sensor 14# error
18	TC sensor 1# error
19	TC sensor 2# error
20	TC sensor 3# error
21	TC sensor 4# error
22	Temperature sensor 1# is disconnected
23	Temperature sensor 2# is disconnected
24	Temperature sensor 3# is disconnected
25	Temperature sensor 4# is disconnected

26	Temperature sensor 5# is disconnected
27	Temperature sensor 6# is disconnected
28	Temperature sensor 7# is disconnected
29	Temperature sensor 8# is disconnected
30	Temperature sensor 9# is disconnected
31	Temperature sensor 10# is disconnected
32	Temperature sensor 11# is disconnected
33	Temperature sensor 12# is disconnected
34	Temperature sensor 13# is disconnected
35	Temperature sensor 14# is disconnected
36	TC sensor 1# is disconnected
37	TC sensor 2# is disconnected
38	TC sensor 3# is disconnected
39	TC sensor 4# is disconnected
40	Emergency Stop !
41	Vacuum error
42	Vacuum problem
43	Vent error
44	Vent problem
45	Purification error 1#
46	Purification error 2#
47	Purification error 3#
48	Injection error
49	Vaporizer problem
50	Vaporizer polarity error
51	Vaporizer polarity invert
52	Vaporizer pot polarity error
53	Compressor problem
54	Door check error
55	High temperature
56	Door's emergency switch is close
57	There is something preventing delivery to be closed properly
58	Bottle lid is not opened
59	There is something preventing the door to be closed.
60	Circuit Breaker for Servo Drive is in off state!
61	Circuit Breaker for 12V30-A power supply is in off state!
62	Circuit Breaker for 12V50-A power supply is in off state!

63	Circuit Breaker for Air Compressor is in off state!
64	Circuit Breaker for Elements Input power is in off state!
65	Circuit Breaker Vacuum Pump is in off state!
66	Safe mode vacuum problem
67	Empty cartridge!
68	Vaporizer element error
69	Vaporizer pot element error
70	Element 1# has Problem!
71	Element 2# has Problem!
72	Element 3# has Problem!
73	Element 4# has Problem!
74	Element 5# has Problem!
75	Element 6# has Problem!
76	Element 7# has Problem!
77	Element 1# has been cold during the cycle !
78	Element 2# has been cold during the cycle !
79	Element 3# has been cold during the cycle !
80	Element 4# has been cold during the cycle !
81	Element 5# has been cold during the cycle !
82	Element 6#has been cold during the cycle !
83	Element 7# has been cold during the cycle !

In the followin, machine errors are reviewed and explanations are provided for each error to resolve the error.

This device has a number of temperature sensors (thermocouples), two atmospheric pressure sensors, and a Pirani pressure sensor.

If any of these sensors displays a number out of the their range, then after a few seconds, this problem will be displayed as an error on the display.

At the beginning, the sensors and heaters of the device are explained:

Pressure sensor # 1 error

This error means that the chamber pressure sensor has an unacceptable value. If you have just replaced the sensor, you might have connected the two sensor pins wrong. This error may result in error from the board or sensor cable. Otherwise, there may be a problem with the sensor.

- Be sure to turn off the device when replacing the sensor.
- Be sure to calibrate the sensors after changing the sensor.
- During the calibration period, the operating range of the sensor must be adjusted correctly, otherwise the sensor error may be displayed again or the pressure may be measured incorrect.
- The default values for the range of the sensor are between -1 and 1 bars (relative).

Pressure sensor # 2 error

This error means that the Vaporizer pressure sensor has an unacceptable value. If you have just replaced the sensor, you might have connected the two sensor pins wrong. This error may result in error from the board or sensor cable. Otherwise, there may be a problem with the sensor.

- Be sure to turn off the device when replacing the sensor.
- Be sure to calibrate the sensors after changing the sensor.
- During the calibration period, the operating range of the sensor must be adjusted correctly, otherwise the sensor error may be displayed again or the pressure may be measured incorrect.
- The default values for the range of the sensor are between -1 and 1 bars (relative).

Pressure sensor # 3 error

This error is related to the Pirani Sensor. This sensor is for measuring vacuum and pressure values less than 10 mm Hg and more than 0.001 mm Hg. To read this sensor, the valve must be open.

If the sensor valve is closed, the value for this sensor will be 12000.

If, after opening the valve of the sensor, the value of this sensor is less than 10 milli Torrs, then after a period of time, the pressure sensor #3 will be displayed.

Also, numbers greater than 12,000milliTorr are false numbers.

- **Note that the number read by this sensor only lies within the sensitivity range when the pressure inside the tank is less than 10 millibar, otherwise the number of this sensor may be incorrect.**
- **Note that the sensor valve is not open for more than 15 minutes. Otherwise, the coil of the valve may be damaged.**

Temperature sensor # 1 error

Displaying this error means that the thermocouple number 1 shows a number out of the range.

Check the connection of the thermocouple to its own socket. A positive thermocouple must be connected in the right way, otherwise the read number will be very large or zero. If the connection is correct, do a short-circuit test with a multi-meter on the two ends of the thermocouple disconnected from the electrical panel of the machine.

If this is a short circuit, check this connection with the body of the device. There should be no connection.

Temperature sensor # 2 error

Displaying this error means that the thermocouple number 2 is numerically out of range.

Check the connection of the thermocouple to its own socket. A positive thermocouple must be connected in the right way, otherwise the read number will be very large or zero. If the connection is correct, do a short-circuit test with a multi-meter on the two ends of the thermocouple disconnected from the electrical panel of the machine.

If this is a short circuit, check this connection with the body of the device. There should be no connection.

Temperature sensor # 3 error

Displaying this error means that the thermocouple number 3 is numerically out of range.

Check the connection of the thermocouple to its own socket. A positive thermocouple must be connected in the right way, otherwise the read number will be very large or zero. Test if connection is correct

Make a short-circuit test with a multi-meter in two ends of the thermocouple detached from the electrical panel.

If this is a short circuit, check this connection with the body of the device. There should be no connection.

Temperature sensor # 4 error

Displaying this error means that the number 4 thermocouple shows a number out of the range.

Check the connection of the thermocouple to its own socket. A positive thermocouple must be connected in the right way, otherwise the read number will be very large or zero. If the connection is correct, do a short-circuit test with a multi-meter on the two ends of the thermocouple disconnected from the electrical panel of the machine.

If this is a short circuit, check this connection with the body of the device. There should be no connection.

Temperature sensor # 5 error

Displaying this error means that the number 5 thermocouple shows a number out of the range.

Check the connection of the thermocouple to its own socket. A positive thermocouple must be connected in the right way, otherwise the read number will be very large or zero. If the connection is correct, do a short-circuit test with a multi-meter on the two ends of the thermocouple disconnected from the electrical panel of the machine.

If this is a short circuit, check this connection with the body of the device. There should be no connection.

Temperature sensor # 6 error

Displaying this error means that the thermocouple number 6 is numerically out of range.

Check the connection of the thermocouple to its own socket. A positive thermocouple must be connected in the right way, otherwise the read number will be very large or zero. If the connection is correct, do a short-circuit test with a multi-meter on the two ends of the thermocouple disconnected from the electrical panel of the machine.

If this is a short circuit, check this connection with the body of the device. There should be no connection.

Temperature sensor # 7 error

Displaying this error means that the thermocouple number 7 is numerically out of range.

Check the connection of the thermocouple to its own socket. A positive thermocouple must be connected in the right way, otherwise the read number will be very large or zero. If the connection is correct, do a short-circuit test with a multi-meter on the two ends of the thermocouple disconnected from the electrical panel of the machine.

If this is a short circuit, check this connection with the body of the device. There should be no connection.

Temperature sensor # 8 error

Displaying this error means that the number 9 thermocouple indicates a number out of the range.

Check the connection of the thermocouple to its own socket. A positive thermocouple must be connected in the right way, otherwise the read number will be very large or zero. If the connection is correct, do a short-circuit test with a multi-meter on the two ends of the thermocouple disconnected from the electrical panel of the machine.

If this is a short circuit, check this connection with the body of the device. There should be no connection.

Temperature sensor # 9 error

Displaying this error means that the number 9 thermocouple indicates a number out of the range.

Check the connection of the thermocouple to its own socket. A positive thermocouple must be connected in the right way, otherwise the read number will be very large or zero.

If the connection is correct, do a short-circuit test with a multi-meter on the two ends of the thermocouple disconnected from the electrical panel of the machine.

If this is a short circuit, check this connection with the body of the device. There should be no connection.

Temperature sensor # 10 error

Displaying this error means that the thermocouple number 10 is numerically out of range.

Check the connection of the thermocouple to its own socket. A positive thermocouple must be connected in the right way, otherwise the read number will be very large or zero. If the connection is correct, do a short-circuit test with a multi-meter on the two ends of the thermocouple disconnected from the electrical panel of the machine.

If this is a short circuit, check this connection with the body of the device. There should be no connection.

Temperature sensor # 11 error

Displaying this error means that the thermocouple number 11 is numerically out of range.

Check the connection of the thermocouple to its own socket. A positive thermocouple must be connected in the right way, otherwise the read number will be very large or zero. If the connection is correct, do a short-circuit test with a multi-meter on the two ends of the thermocouple disconnected from the electrical panel of the machine.

If this is a short circuit, check this connection with the body of the device. There should be no connection.

Temperature sensor # 12 error

Displaying this error means that the thermocouple number 12 is numerically out of range.

Check the connection of the thermocouple to its own socket. A positive thermocouple must be connected in the right way, otherwise the read number will be very large or zero. If the connection is correct, do a short-circuit test with a multi-meter on the two ends of the thermocouple disconnected from the electrical panel of the machine.

If this is a short circuit, check this connection with the body of the device. There should be no connection.

Temperature sensor # 13 error

Displaying this error means that the thermocouple number 13 is numerically out of range.

Check the connection of the thermocouple to its own socket. A positive thermocouple must be connected in the right way, otherwise the read number will be very large or zero. If the connection is correct, do a short-circuit test with a multi-meter on the two ends of the thermocouple disconnected from the electrical panel of the machine.

If this is a short circuit, check this connection with the body of the device. There should be no connection.

Temperature sensor # 14 error

Displaying this error means that the thermocouple number 14 is numerically out of range.

Check the connection of the thermocouple to its own socket. A positive thermocouple must be connected in the right way, otherwise the read number will be very large or zero. If the connection is correct, do a short-circuit test with a multi-meter on the two ends of the thermocouple disconnected from the electrical panel of the machine.

If this is a short circuit, check this connection with the body of the device. There should be no connection.

Temperature sensor # 1 is disconnected

Displaying this error means that the temperature sensor connector number 1 is disconnected. Check that the connection is established.

Temperature sensor # 2 is disconnected

Displaying this error means that the temperature sensor connection number 2 is disconnected. Check that the connection is established.

Temperature sensor # 3 is disconnected

Displaying this error means that the temperature sensor connection number 3 has been disconnected. Check that the connection is established.

Temperature sensor # 4 is disconnected

Displaying this error means that the temperature sensor connection number 4 has been disconnected. Check that the connection is established.

Temperature sensor # 5 is disconnected

Displaying this error means that the temperature sensor connector number 5 is disconnected. Check that the connection is established.

Temperature sensor # 6 is disconnected

Displaying this error means that the temperature sensor connector number 6 is disconnected. Check that the connection is established.

Temperature sensor # 7 is disconnected

Displaying this error means that the temperature sensor connection number 7 has been disconnected. Check that the connection is established.

Temperature sensor # 8 is disconnected

Displaying this error means that the temperature sensor connector number 8 is disconnected. Check that the connection is established.

Temperature sensor # 9 is disconnected

Displaying this error means that the temperature sensor connection number 9 has been disconnected. Check that the connection is established.

Temperature sensor # 10 is disconnected

Displaying this error means that the temperature sensor connection number 10 has been disconnected. Check that the connection is established.

Temperature sensor # 11 is disconnected

Displaying this error means that the temperature sensor connector number 11 is disconnected. Check that the connection is established.

Temperature sensor # 12 is disconnected

Displaying this error means that the temperature sensor connector number 12 is disconnected. Check that the connection is established.

Temperature sensor # 13 is disconnected

Displaying this error means that the temperature sensor connection number 13 has been disconnected. Check that the connection is established.

Temperature sensor # 14 is disconnected

Displaying this error means that the temperature sensor connector number 14 is disconnected. Check that the connection is established.

• If in the settings of the cycle, on the **Settings** page, the **Test** items of the elements are activated, after the device is turned on, the device will test its heaters not to be faulty. If an element is defective, the error associated with that element will be displayed.

Heater element # 1 error

Heater element # 2 error

Heater element # 3 error

Heater element # 4 error

Heater element # 5 error

Heater element # 6 error

Heater element # 7 error

Element error

Vaporizer element error

Vaporizer pot element error

If there was a problem with the heaters during the cycle and the heaters does not work and stay cool or cooled down, the following errors may occur.

If so, stop the cycle, turn the device off and test the heaters separately.

Heater temperature is low

Door temperature is low

Exhaust temperature is low

The device has 8 miniature circuit breaker in different flow rates. Also, the device is equipped with a main circuit breaker that turned off if the leakage current exceeds 30mA this circuit breaker is used to protect against leakage currents.

40A miniature circuit breaker for power input device

32A miniature circuit breaker for device heaters

16-amp miniature circuit breaker for servo motor drive

Miniature circuit breaker for 12 V power supply

Miniature circuit breaker for 24 V power supply

Miniature circuit breaker for air compressor

Miniature circuit breaker for PLC

Miniature circuit breaker for the internal boards of the electrical control panel.

Among these miniature keys, except for the input power key, and the internal boards, the rest of the keys have output feedback and can be checked for interruption in the software. It is not possible to get the feedback from the 24-volts fuse or PLC fuse because they will be turned off and cannot display the error.

These errors are displayed in the display called Fuse Error

Emergency Stop!

This warning is displayed if the emergency stop button on the main panel is pressed.

In this case, all outputs of the device are inactive. By deactivating this switch the warning will be disappeared

This switch is a normally close connection.

In case of after deactivating this switch, the warning remained on the screen and the device outputs were disabled, it may be due to the switch cable's failure to connect to the key or the failure of the key itself.

Communication errors:

These errors occur when the communication cables between the device modules are disconnected or the device is launched in a very noisy environment. This problem may also be due to faulty modules or PLCs.

Vaporizer communication error

This error indicates a connection failure or an error in the connection between the PLC and the vaporizer controller board.

Plasma communication error

This error indicates a connection failure or an error in the connection between the PLC and the plasma range of the generator.

Vaporizer and plasma communication error

This error indicates a connection failure or an error in the connection between the PLC and the plasma generator or the vaporizer controller board or both.

Temperature controller communication error

This error indicates a connection failure or an error in the connection between the PLC and the temperature control module.

Door (s) communication error

This error indicates a connection failure or an error in the connection between the PLC and the servo drive (s).

Temperature controller and door (s) communication error

This error indicates a connection failure or an error in the connection between the PLC and the servo drive (s) or temperature control module, or both.

There is something preventing delivery to being closed properly

At the time of closing the delivery block, if something prevents the block to close, this error will be displayed. And as the consequence, the delivery block will be moved outside in order to remove the obstacle from the closing path.

If this error is incorrectly displayed, it may have been due to mis-adjusting the optical sensor behind this unit.

Adjust the sensor in a state that can be activated by pushing the spring up to 15 mm.

Bottle lid is not opened

If the cartridge's lid is not opened while the cartridge is loaded, and the cartridge is placed inside the delivery block with the lid on it. After the block is moved inside and the nozzle moved down, the bottle cap error will be displayed, and with this error, the nozzle first goes up so that the block can move freely, then the block will move to the outside and the user can see the error indicating the message to open the lid.

If this error appears continuously on the screen, it may be due to false calibration of the sensor or defective optical sensor.

Empty cartridge!

As it is known, if an empty cartridge is inserted into the machine, the empty cartridge error will be displayed.

If the cartridge is full and this error is displayed again, the following may be occurred:

- The vaporizer coupling hose may be blocked or cutted off.
- Vacuum valve may have problem

- The hydrogen peroxide valve may have problem
- The up/down pneumatic cylinder may have problem and the nozzle does not enter the cartridge.
- The electro-pneumatic valve of up/down pneumatic cylinder may have problem.
- Condensation valve may have problem
- The vacuum pump may not be turned on or have problem
- The vent valve or corresponding electro pneumatic valve have problem
- The vacuum valve or its electro pneumatic may have problem

Compressor problem

This error is displayed if the compressor is switched off after the turning on command and the time specified in the settings of this unit passed but the pressure switch signal from the air compressor does not sent.

- The air compressor pressure is essential for progress of the cycle.
- This may be due to a failure in the compressor.
- The compressor may be turned off.
- It might that compressor adjusting pressure knob and the pressure switch that installed on the compressor is not match with eachother. Note that the pressure set on the pressure knob should be slightly more that the pressure switch adjusted pressure so that when the compressor breaks it could be guessed; Otherwise the software will make mistake in detecting the trouble.

- **Errors that are likely to be related to the vacuum section.**

Vacuum error

Vacuum problem

Purification error # 1

Purification error # 2

Oil Pump and oil filter are overused, replace it.

The filter is not working.

Filter error

Filter problem

Filter valve error

Filter sensor error

The filter is in danger.

Safe mode vacuum problem

Safe mode High vacuum problem

Vacuum error

This error occurs during the cycle and occurs when the vacuum pump cannot reach the specified pressure at the specified time. This error is intended only to inform that the vacuum pump may be in trouble, but in any case this error is a serious error.

When this error is detected, the machine automatically checks the device's door to be closed. Then it sends the valves's status signal again.

Note that when you are servicing the device, when this error occurred, you have to turn the device off.

The causes of this error might be:

1- The device's heaters may have problem

Check the resistance of the heaters, They should have about 100 ohms.

2- The set time that adjusted for vacuum unit to reach the vacuum or the pressure that had been set, might be miss-adjusted.

In this case, by checking the short and long cycle parameters, ensure the correct setting for the vacuums applied in the machine, and check the vacuum parameters to ensure that the time adjusted for the vacuum is correct.

If something is suspicious, press the default item, the values will set to the default values.

3- Connections and piping may have leakage

In this case, open the vacuum connections, lubricate the O-rings with special vacuum grease, then tighten the clamps.

4- Vent, vacuum, or condenser valves may have problem.

Open the valves and check them separately, check the O-rings of valves that are not broken and they are in their place correctly.

5- Electro-pneumatic valves may have problem

After turning on the device, check the electro-pneumatic valves inside the control panel by manual triggering them.

6- The oil level of the vacuum pump may not be enough.

Look for a leak, in order to not have any leakage.

If the oil level is low, add some special oil (Grade 19) from the top of the pump. (The appropriate limit is indicated on the pump, for example, in the off mode, half of the pump's sight glass should be filled with oil, or in the pump's on state, at least one quarter of the distance between the minimum and maximum level should be filled with oil)

7- Change oil if more than 500 cycles have passed since the last time the pump's oil has been replaced.

8. The door of the machine may not be properly closed.

Make sure the O-Ring of the door is placed in its proper place by opening the door and checking it.

Vacuum Problem

This error occurs when the unit was unable to reach the desired pressure during the cycle in the specified time and after sending the valves status command again and giving a second chance to the vacuum unit to vacuum the chamber in the specified time, it couldn't vacuum the chamber again.

Note that if this option in error setting is enabled in the device, then the machine cycle stops after this error occurs.

The causes of this error can be these:

1- The device's heaters may have problem

Check the resistance of the heaters, They should have about 100 ohms.

2- The set time that adjusted for vacuum unit to reach the vacuum or the pressure that had been set, might be miss-adjusted.

In this case, by checking the short and long cycle parameters, ensure the correct setting for the vacuums applied in the machine, and check the vacuum parameters to ensure that the time adjusted for the vacuum is correct.

If something is suspicious, press the default item, the values will set to the default values.

3- Connections and piping may have leakage

In this case, open the vacuum connections, lubricate the O-rings with special vacuum grease, then tighten the clamps.

4- Vent, vacuum, or condenser valves may have problem.

Open the valves and check them separately, check the O-rings of valves that are not broken and they are in their place correctly.

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After turning on the device, check the electro-pneumatic valves inside the control panel by manual triggering them.

6- The oil level of the vacuum pump may not be enough.

Look for a leak, in order to not have any leakage.

If the oil level is low, add some special oil (Grade 19) from the top of the pump. (The appropriate limit is indicated on the pump, for example, in the off mode, half of the pump's sight glass should be filled with oil, or in the pump's on state, at least one quarter of the distance between the minimum and maximum level should be filled with oil)

7- Change oil if more than 500 cycles have passed since the last time the pump's oil has been replaced.

8- The door of the machine may not be properly closed.

Make sure the O-Ring of the door is placed in its proper place by opening the door and checking it.

Purification error # 1

Purification error # 2

These two errors may occur during the cycle and at the beginning of the purification process. If these errors are enabled in the error settings, then the cycle will be stopped if the error happens again. The cycle first attempts to send the vacuum commands again, then if the errors occurred again then the cycle will be stopped.

Note that these two errors are not specific to the vacuum unit and are related to the start of the condensation process. At the beginning of this process, the pressure of the vaporizer has to be 120 millibars, and if this does not occur at a specified time, it would be indicated by purification error # 1.

In the process, the valve of hydrogen peroxide is closed and the condenser valve is opened to bring the pressure to less than 100 millibars. If this does not occur at the specified time, the purification error # 2 will be shown.

In fact, these two errors are related to condenser valves and the detection of the opening of these two valves.

To detect the complete closure of these two valves, you should also use the vacuum test on the configuration page.

If these two errors happen on the machine, first stop the cycle. Then do the following:

- 1- When these two errors occur, the vacuum unit may be in trouble. Check the vacuum unit performance. (You can do the vacuum test.)
- 2- If the vacuum test is successful, check the electro pneumatic valves of hydrogen peroxide and condensate valves. The coils must be doing well. Also check valve function by manual triggering.
- 3- If both of the above items are checked and are ok, open condenser valve and hydrogen peroxide valve from the condenser's head and check the pneumatic valve and their O-rings.

Oil Pump and oil filter are overused, replace it.

The filter is not working.

Filter error

Filter problem

Filter valve error

Filter sensor error

The filter is in danger

Bimetal error

- These errors are related to the vacuum unit filter and the vacuum pump's oil.
- According to the error settings, each of these errors can be able to stop the cycle.

Oil Pump and oil filter are overused, replace it.

As it is known, it is related to the replacement of the filter and the vacuum pump's oil. In fact, this error occurs if the counter of cycles (total cycles) reaches the value of the change filter value, in the parameter setup page. In this case, it is better to replace the filter.

Filter is not working error

It happens when the filter counter is close to the filter replacement value. 10 cycles before the set value, this error is displayed. In this case, it is better to replace the filter

Filter Error

Filter Error occurs when after the specified number of cycles, water is not collected in the filter. In this case, this error indicates that the filter does not separate water properly.

Check the sensitivity of the sensors, It might that the blades in the filter are dirty. If these are not happened, then the filter has problem and should be replaced.

The Filter Problem error

The Filter Problem error happens when the number of cycles that has been taken without draining the water inside your filter, has exceeded the limit value.

Check the sensor sensitivity of the filter. The sensor may be dirty inside the filter. Otherwise, there is a problem with the filter and should be replaced.

The Filter Valve Error

The Filter Valve Error occurs when the water drain command is sent from the filter and opens the valve, but the water inside the filter does not drain at the specified time. This error, therefore, indicates that the filter valve's coil has been damaged.

Turn the device off and after 10 seconds turn it on again. If the error is not resolved, check the filter drain valve. If the valve is healthy, select the default option from the Settings menu and the Cycle Parameters option to change the default values.

The filter sensor error

The filter sensor error occurs due to the wrong connection of the low and high blades. The filter must always be filled with water up to low level, and if the low and high contacts are active, this error indicates that there are two blades connected incorrectly or there is a problem with the sensor.

If the sensitivity of the blades has been set correctly, this error should not happen. If both sensors are in good condition, replace the two sensors and check the filter again.

The Filter is in danger

The Filter is in danger, occurs when both low and high blades are disabled in the filter sensor. This means that the water drain valve in the filter is likely to be spoiled or leaky and it may discharge the pump oil, and then the pump runs without oil and causes a pump failure.

Check the valve below the filter and check that it has not any leakage.

If you change the filter, be sure to select the options for switching filters and resetting their counters from the Settings page.

Bimetal error

If the vacuum pump take more current than the adjusted value, the thermal switch which protecting the vacuum pump, will cut off the connection. If this error occurs, the cycle will stop.

Check the vacuum pump, when the machine is off, turn the fan at the back of the pump by hand. If it rotates easily, the circuit breaker may be adjusted to a wrong current. Set this value to a greater amount.

If the fan is not rotated easily, it may be a problem with the vacuum pump, the outlet filter, or the motor of this pump. Open the outlet filter with care from the pump. Check the pump oil level. Rotate the fan again. If it's not easy to rotate, the problem is with the pump or electromotor and if it is easy to rotate,

it means that the pump's outlet filter is saturated and does not allow the air to flow out, and this will be dangerous for the pump. In this case, replace the output filter. Then turn the thermal key back to active state.

Vent error

This error occurs when the device requires a higher pressure, but after sending the vent command and a specified time passed, the pressure has not reached the desired value. After the error occurred, the vent command will be sent once more.

Vent problem

If the vent error does occur again after the re-sented command then the error will occur.

If the vent error option is selected in the error settings, then the cycle will be stopped after this alarm.

First, check the vacuum electro pneumatic valve. The corresponding solenoid may be broken.

Check the air compressor that there is no fault and provide the proper air pressure.

Check that the valve is doing right.

This error may also be due to the problem in the vacuum unit. If the vacuum is not taking place at all, then the vent process will be basically meaningless, so this error may also be due to the problem in the vacuum unit.

There is something preventing the door to be closed.

This error occurs when the door is lowered and face an obstacle in the movement of the door. The sensor located on the under-door detects these objects and prevents closing the door.

In the event that the door's sensor is activated incorrectly and the door does not come down and this error is displayed, it may be a problem with the sensor or its incorrect connection to the door or control panel.

Doors check error

The software of device checks whether the door is well closed at the beginning of the machine cycle or not. This will start by applying the door closing command, and then the pressure difference is measured in a few seconds when the vacuum pump is switched on and the vacuum valve is opened.

This error is displayed if the door is not closed properly.

In the device software it is set to open the door of the unit after the error, so that it can be checked whether the door is in place or not.

This error may also occur due to vent valve or water vapor.

If this error continues to occur after closing the door, stop the cycle and check the vacuum and vent valves.

Door emergency switch is closed

Two sensors have been used to detect the opening of the door. The first sensor is a capacitive sensor that is set where the door of the device should normally open.

Another switch is also provided for emergency stop for door movement. If the capacitor is inactive, the door will move to the top of it will continue its movement, but the second switch will be prevented from moving the door to hit the cover.

If this switch is triggered, it must be known whether the capacitive sensor of the door is in trouble or not adjusted properly.

This error may occur if door sensors are not properly set up.

Set the sensors in a way that the door opens in its open position and in the case where the shelves of the device can easily come out, trigger the capacitor, and also set the emergency switch so that the door does not open too far up to The device covers and damages the device.

Purification error # 3

This error occurs when the temperature of the condenser is not reached to the required at the specified time.

The cause of this error may be these:

Problems with condenser thermocouple

The condenser has three temperature sensors. The accuracy of all three thermocouples can be checked by detaching them from the control panel.

Problems with Condenser Drivers

LEDs on the control board will be off if there is a problem with the driver board.

Also, by cutting off the output and testing the output voltage, it can be ensured that the voltage range is correct if the LEDs are turned on.

The problem in condenser elements

You can use the condenser checking program on the settings page to check the condenser elements.

Also, if a clamp ampere meter is available that can measure the DC current with, it can be ensured by measuring the flow rate from the correct operation of the heaters.

Problems with condenser power supply

Make sure that the power supply is working correctly with the voltage test as well as the connection of a consumer directly to the power supply.

In the absence of any problem, when the condenser is completely switched off, the current output must be above 50 A from the output of the drive range.

Injection error

This error occurs if the vaporizer pressure has not reached the required value in the duration considered for this increase. This may happen due to the following:

- Excessive condensation

- Vaporizer Driver Problems
- There is a problem with the power supply
- Vaporizer's pressure sensor problem
 - If the sensor correctly measures pressure in the atmosphere and it is calibrated, it should not be a problem.

- Low intake of hydrogen peroxide into the condenser
 - This amount is set in the factory before leaving the machine and should not be changed. If you want to adjust this value, the adjustment knob can be rotated to the optimum level.

- The fault of the Delivery valves

Note that this error is for informing only and must be corrected by itself. If there is a problem, the cycle will stop and most likely an error occurred in the valves of delivery unit. So test the delivery valves.

Vaporizer problem

This error will be displayed in case of any error in the condenser.

Vaporizer polarity error

Vaporizer polarity inverted

If the temperature of the vaporizer decreases or does not change correctly by sending the increase temp command, these two errors occur. Replace the positive and negative poles of the vaporizer.

Vaporizer pot polarity error

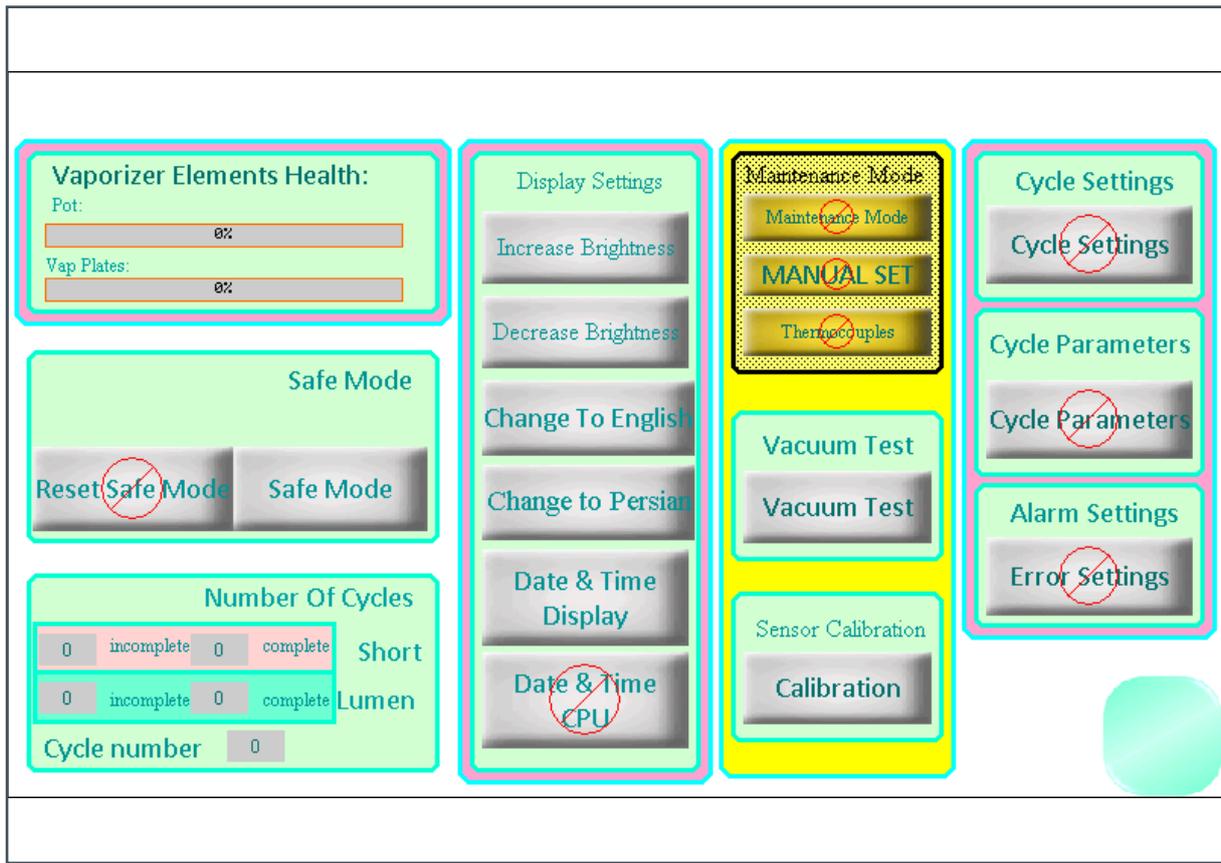
If the temperature of vaporizer's pot, decreases or does not change correctly by sending the increase temperature command, these two errors occur. Replace the positive and negative poles of the vaporizer's pot.

Chapter six

Device Setup page

On this page there are the following features:

- **Ability to test the condenser**
- **Ability to change display light**
- **Ability to change system clock**
- **Ability to run a safe-mode cycle**
- **Ability to cancel the safe-mode necessity**
- **View the number of complete and incomplete, short and long cycles**
- **Ability to reset filter counters**
- **Maintenance Mode:**
 - In this mode, some limiting conditions are fixed to enable the company's specialists to perform specific repairs
- **Ability to manually change the software process**
 - In the event that a part of the device is broken, but the progression of the cycle is important, this section can be modified in the program process to progress the cycle.
- **Ability to run vacuum test**
 - In this section, by selecting the vacuum test option, the device initially opens the device's valves to reach the atmospheric pressure.
 - After a few seconds, the pump will be switched on and the vacuum valves and the condenser valves are closed. The door of the machine will also be closed, and a timer will take about 200 seconds to power the system, and after that it will open the sensor valve and measure the pressure after 240 seconds, then the vacuum valve will be closed and any leakage will be checked also.
 - Valid values for vacuum testing:
 - Pressure after 4 minutes: less than 800 milliTorrs
 - Leakage after 1 minute: less than 400 milliTorrs
- **Possibility of calibration of pressure sensors**
 - In this section, enter the zero pressure in milliTorrs, the maximum and minimum range of pressure sensors has to be entered, then the vacuum calibration option is selected and the pressure sensors are calibrated automatically.
- **Ability to set errors that stops the cycle**
 - The possibility of changing the parameters of the cycle and the process
- **Ability to change device settings**



Chapter seven

Manual Control page

In this page all of the actuators of the device can be control manually. This is so important to consider the actutors priority before changing the state of them.

The screenshot displays a complex manual control interface with the following sections:

- Door Panel (Green):** Includes buttons for 'Servo', 'Door Up', 'Servo On', and 'Door Down'. Below are 'Down Switch' and 'Up Switch' buttons, and a table for feedback values:

L.S.	Speed	0
	Torque Limit	0
	Alarm	0
	Torque Feedback	0
	Speed Feedback	0
- Vac valve Panel (Cyan):** Features '12 V' and 'Fan' buttons, an 'Apply Temp' button with a '0' display, and a 'Pot' control with three '0' displays.
- Machine Fan Panel (Cyan):** Includes 'Machine Fan' and 'Apply Temps' buttons, and 'body' and 'Exttmp' controls with '0' displays.
- Body Temp Control Panel (Cyan):** A grid of controls with columns for 'T#', 'Heater', 'Temp.', and 'C%'. Buttons include 'door', 'back', 'up', 'down', 'left', 'right', and 'exhst', each with a '0' display.
- Container Panel (Green):** A list of components: 'servo drive', 'Fuse 12V-30A', 'Fuse 12V-50A', 'AirCompressor', 'Fuse Heaters', and 'BiMetal'.
- Plasma Panel (Pink):** Shows 'V.Out' (0), 'P.Out' (0), and 'C.Out' (0) displays, along with a 'Plasma' button.
- Control Buttons (Yellow/Green):** Includes 'OFF vac pump', 'Pressure Switch', 'OFF Lang2', and a directional keypad with 'back', 'forward', 'up to end', 'up', 'down to end', and 'down' buttons.
- Valve Panel (Cyan):** Shows 'valve 1', 'valve 2', and 'valve 3' with associated 'back to end' and 'forward to end' buttons.
- Header:** A digital clock displays '09:05:57'.

