NÜVE SANAYİ MALZEMELERİ İMALAT VE TİCARET A.Ş.

NC 40M

VERTICAL LABORATORY STEAM STERILIZERS

SERVICE MANUAL

CE

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CONTENT

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SECTION 1
INTRODUCTION

1.1. PURPOSE OF THE SERVICE MANUAL

This manual includes servicing and maintenance information for NC 40M Vertical Laboratory Steam Sterilizers. It is prepared to be used by engineers and technicians who were formerly trained by only Nuve. This manual informs the engineers and technicians about the operating principles, diagnosing and repairing methods and spare part replacing.

If any problem is detected which is not identified in this manual, please contact to Nuve Service engineers.

1.2. GENERAL PURPOSE OF THE UNIT

The heating function on NC 40M unit is provided by means of the heater placed inside the sterilization chamber. The sterilization cycle consists of the heating, sterilization and cooling.

Heating : Before the sterilization cycle, the chamber is heated to reach required sterilization temperature.

Sterilization : When the chamber temperature reaches to the set sterilization temperature, sterilization starts. The sterilization chamber is kept at the required temperature during the set time.

Cooling : During the cooling phase, the steam in the sterilization chamber is being cooled by the cooling fan, until the pressure decreases to zero. The samples are cooled in this phase.

NC 40M Vertical Laborotory Steam Sterilizers have 5 pre-set program as follows;

- Liquid 121°C 15 minutes
- Liquid 121°C 20 minutes
- Solid 121°C 20 minutes
- Solid 134°C 20 minutes
- Solid (Quick) 134°C 4 minutes

NC 40M sterilizers have two special programs for liquid and solid materials. In these special programs, sterilization temperature is programmable between 105°C and 135°C and sterilization timer is programmable between 1 - 300 minutes. Also, there is a special melting program of which the temperature is programmable between 60°C and 100°C and timer is programmable between 1 - 60 minutes.

The steam is produced by the heater located inside the chamber and thus, a homogenous temperature distribution is maintained within the sterilization chamber. The optional pre-

heating system decreases the process duration. All parts which are exposed to steam and water are made of stainless materials.

All procedures are carried out automatically without any interference.

NC 40M presents supplementary protection with their integrated safety thermostat, safety valve and surface thermostat in addition to the safety features of its control system (i.e. high pressure, high temperature).

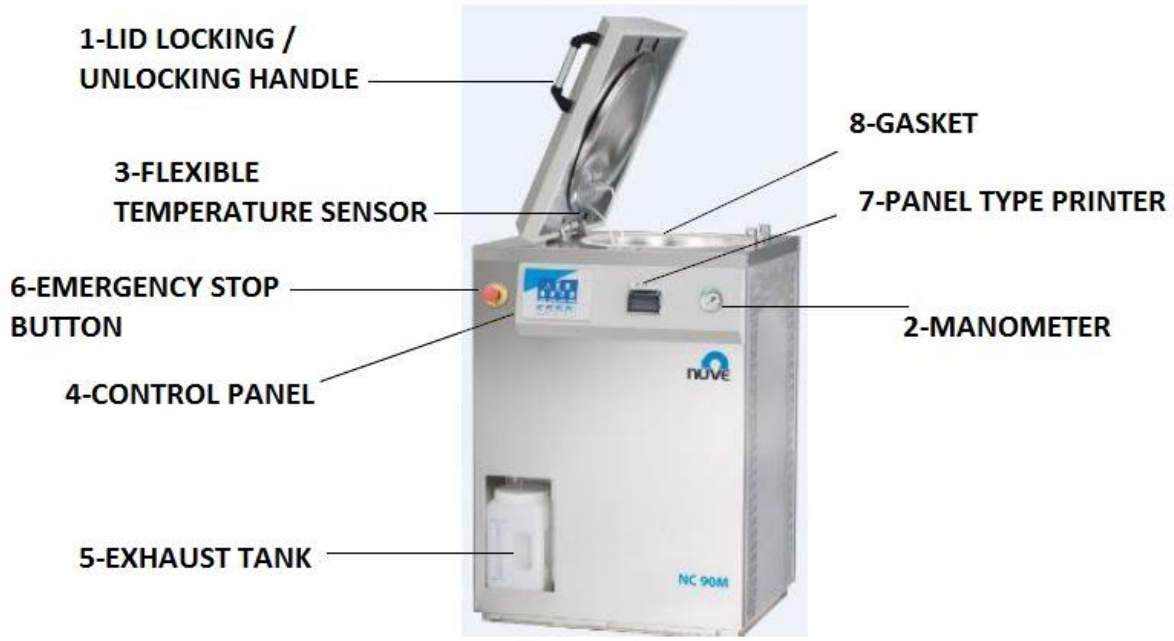

Figure 1

SECTION 2
OPERATING PRINCIPLES

NC 40M could be examined in 5 main categories:

- Power Supply
- **N-smart** Control Unit
- Control Panel
- Heating Unit
- Steam Unit

NC 40M works with 230 VAC and 50/60 Hz.

Fuse	Power Supply	Power Inlet	Heater Type
1 x 16 A	2500 W	230 VAC~ 50/60 Hz	Circle type stainless heater

N-smart controlled mainboard works with proportional control system. The distilled water is filled until the shelf level which is placed above the heaters and cycle is started. The mainboard first starts heating process and heating goes on until reaching to the sterilization temperature of choosen program. Sterilization process continues during sterilization time of choosen program. After sterilization, cooling process starts and cycle is completed after satisfaction of door opening condition. Door opening condition is 80 °C and 1 minute for liquids, 96 °C and 5 minutes for solids.

All command and control equipments are connected to the mainboard as following;

- Temperature Sensors
- Display
- Heating group supply terminals
- Fan

2.1. CONTROL PANEL (DISPLAY)

Control panel is showed on Figure 2. View the user manual to reach more detailed information.

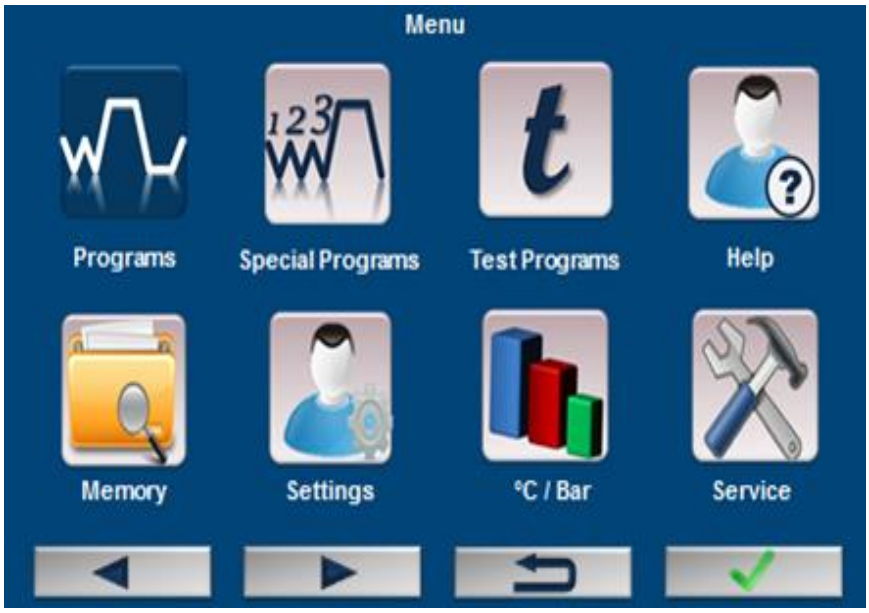

Figure 2

The functions of F1, F2, F3 and F4 keys depend on the meaning of the corresponding symbol appearing on the display. That is why these keys are named with “F” which is first letter of function.

2.2. HEATING UNIT

Heating on NC 40M is provided 1 stainless heater which is placed in the chamber and jacket heaters which is covered around of chamber.

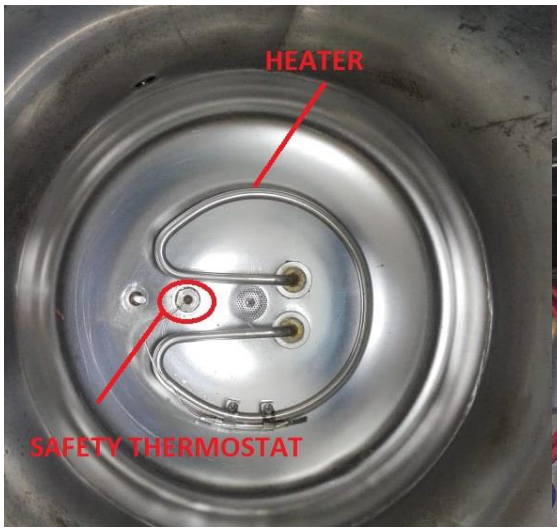

Figure 3

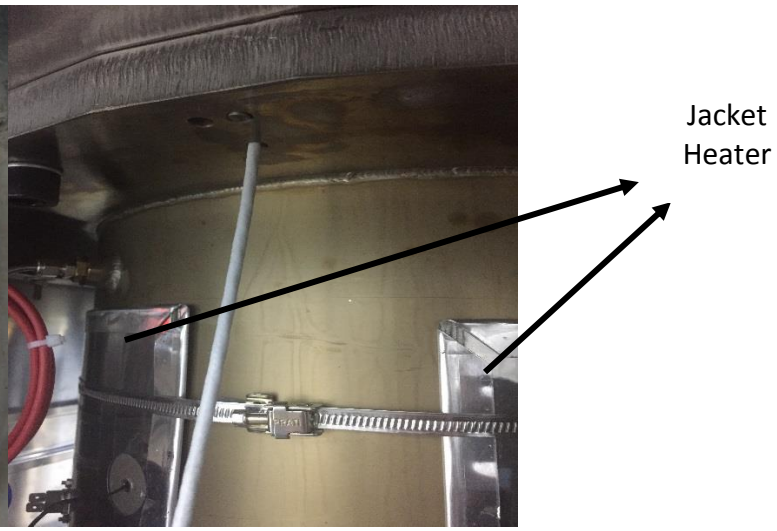

Figure 4

If heaters are not activated although any program is started, chamber temperature thermostat should be checked before heaters, safety thermostat, solid state relay or mainboard. In case of red flash on this thermostat, reset button should be pressed and green led should be flashed to activate heater. Otherwise, heaters are not powered. See Figure 5 and Figure 6.

Figure 5

Figure 6

2.3. WATER AND STEAM UNIT

The steam is produced by distilled water that is heated by the heaters which are placed inside the chamber. The pressure in the sterilization chamber can be followed on the manometer.

The steam solenoid valve is operated by the main PCB.

The sterilization chamber safety valve operates if the pressure inside the chamber exceeds 3 bars and it discharges the excess steam which leads to over-pressure.

NC 40M presents supplementary protection with its integrated safety thermostat, safety valve and surface thermostat in addition to the safety features of its control system (i.e. high pressure, high temperature). If there is not enough water in the chamber, safety thermostat stops the circuit to protect heater. Before operating the unit, safety thermostat should be reseted by pressing green button which is placed at the back side of autoclave as shown on Figure 7.

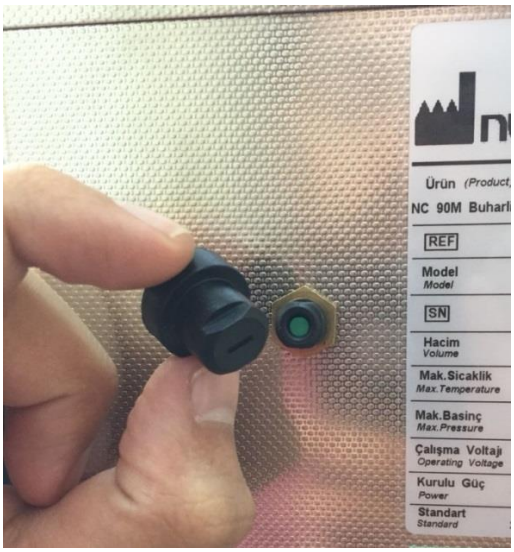

Figure 7

The exhaust tank is placed on the bottom side of the unit. The condensed steam is sent to the this tank. There should be water between minimum and maximum level in the exhasut tank.

The components of the water and steam unit are listed below:

- Heater
- Temperature Sensor
- Solenoid Valve
- Steam Trap
- Safety Valve (3 Bar)

SECTION 3
SERVICING

Before servicing the instrument, please take the necessary precautions for your safety. Please respect to the warnings on the unit!

Please make sure that you have disconnected power of the unit before servicing.

3.1. GENERAL OVERVIEW

The failures can be diagnosed according to the following tables. Most of the arising problems can be determined by the help of a multimeter.

The components on the main PCB must not be replaced even the failure is caused by one of the components on the main PCB. In this case, please contact with Nuve Service.

Before replacing the PCB or any control element, please make sure that the failure is not caused by weak wire and terminal connections.

3.2. GENERAL FAILURES

1) The On/Off switch is ON, but it is not lightened and the display is blank.

1. Check the communication cable between mainboard and display. Replace the cable if it is faulty.
2. Check if mains voltage is supplied to the unit.
3. Check the fuse.
4. Check the On/Off switch. Replace the switch if it is faulty.
5. Replace the display.
6. Replace the mainboard.

2) The On/Off switch is OFF, but display is ON.

1. The connection of On/Off switch is wrong. Fix it.

3) The fuse blows frequently.

1. • Check if there is short circuit on chamber heaters, jacket heater and locking system with multimeter.
2. • Check if there is short circuit on other electrical terminals and cables such as solenoid valve bobbins.
3. • There might be electrical leak on condense solenoid valve.

4) The pressure in the sterilization chamber does not increase.

1. • Check the lid gasket. Replace it if there is steam leak from lid.
2. • There might be steam leak on condense solenoid valve. Replace it.
3. • Steam trap might leak, replace it.
4. • The safety valve might be open. Close the valve by turning it to the counter clockwise direction.
5. • Check the chamber heaters. Replace faulty heater(s). Use new heater seal while it is being replaced.
6. • Check solid state relay of heaters. Replace it if it is defective.
7. • Check SSR output of mainboard by multimeter. Replace mainboard if there is no voltage on SSR output of mainboard (12 V DC).
8. • Replace the manometer.

5) The lid leaks steam.

1. • Check if there is any material between the lid and the gasket.
2. • Replace the lid gasket.
3. • Tighten the lid adjustment screw by turning it to the clockwise direction.

6) The lid is not locked when the steam sterilizer starts operating.

1. • Check locking coil operation mechanism.
2. • Check locking coil board/diode and locking coil. Replace if one of them is defective.
3. • Check locking coil output of mainboard by multimeter. If there is no voltage (230 VAC), replace the mainboard.

7) The lid lock pin is not released even the pressure in the chamber decreases to zero.

1. • Check locking coil operation mechanism.
2. • Check locking coil board/diode and locking coil. Replace if one of them is defective.
3. • Check pressure automatic for door opening. Replace it if it is defective.
4. • Check locking coil output of mainboard by multimeter. If there is no voltage (230 VAC), replace the mainboard.

3.3. ERROR CODES AND SOLUTIONS

ERROR 6 – DOOR OPEN

1. • Lid Switch is defective. Make adjusment and bend the switch stick a bit. If problem cannot be solved by bending stick, replace it.
2. • Replace the mainboard.

ERROR 10 – SENSOR FAILURE PT1, PT2, PT3, BT1, BT2

1. • If mainboard or display was replaced recently, switch on the autoclave and check the model name at the beginning page of Display. If it says another model, update the software and make model selection from Display.
2. • Check if there is damage or weak connection on mainboard output of chamber temperature sensor (Pt-1), load temperature sensor (Pt-2) and jacket temperature sensor (Pt-3). Replace if any sensor(s) is defective
3. • Replace the mainboard.

ERROR 12 – PRE-HEATING HIGH TEMPERATURE

1. • Jacket thermocouple (Pt-3) is defective. Replace the thermocouple.
2. • Replace the solid state relay of jacket heater.
3. • Check SSR outputs of mainboard by multimeter. If there is no voltage (12 VDC), replace the mainboard.

ERROR 14 – THE DURATION FOR DOOR LOCKING HAS EXCEEDED THE PERMITTED PERIOD

1. • Lid locking pin is stucked, check the pin.
2. • Replace the locking coil and diode/locking board.
3. • Check if there is voltage on locking system output of mainboard.
4. • Replace the mainboard.

ERROR 17 – HEATER FAILURE

1. • Check the thermic relay if it is on "I" position.
2. • Make sure that there is not any problem on any of phase lines. Check the voltage between each phase line and neutral line.
3. • Check digital chamber temperature thermostat. Reset it if it flashes red.
4. • Check the resistances of heaters with a multimeter. Replace defective heater(s) if multimeter shows short circuit or strange ohm values.

ERROR 19 – LOW TEMPERATURE (This error appears in case of decreasing PT-1 temperature for Solid Programs and PT-2 temperature for Liquid Programs 2 degrees below of set temperature after sterilization starts. If melting program is selected, error appears when the temperature is 10 degrees less than set temperature.)

1. • Check heater SSR. Replace it if there is not 230 VAC on its output.
2. • Lid leaks. Follow the procedure on 5th step on General Failures.
3. • Check thermocouple terminals on mainboard.
4. • Check heater outputs on mainboard. If there is not 12 VDC, replace the mainboard.

ERROR 20 – HIGH TEMPERATURE (This error appears when PT-1 or PT-2 sensors shows 4 ^{o}C more than set degrees. It is 10^{o}C for melting program.)

1. • Check chamber and load temperature sensors output of mainboard if there is any loose or damaged connection. If there is a damage, replace the sensor.
2. • Check SSR terminals of mainboard by a multimeter. If there is always 12 VDC, replace the mainboard.
3. • Check jacket heater SSR if there is always 230 VAC on its output. Replace it if there is always 230 VAC.
4. • Check chamber heater SSR if there is always 230 VAC on its output. Replace it if there is always 230 VAC.

ERROR 22 – HIGH PRESSURE (This error appears In case of high pressure in the chamber)

1. • Check loading method and follow the loading rules in the User Manual.
2. • Follow the steps on error 21.

ERROR 35 – EXHAUST TANK (This error appears when exhaust tank is taken out from its place.)

1. • Make sure that exhaust tank is placed well.
2. • Make sure that water level in the exhaust tank is at least on minimum.
3. • Replace the exhaust tank switch.
4. • Replace the mainboard.

ERROR 36 - TEMPERATURE SENSOR (This error appears in case of PT-1, PT-2 or PT-3 sensors read more than 170 ^{o}C)

1. • Check all of sensors if they have damage or loose connection on mainboard terminals.
2. • Temperature sensors might be faulty. Replace if there is faulty sensor.

ERROR 37 – INSUFFICIENT WATER (This error appears in case of insufficient water in the chamber)

1. • Reset the gas safety thermostat.
2. • Make sure that there is water on shelf level in the chamber. After adding water, press green switch as shown on Figure 7.
3. • Check "No Water" relay's connections. Replace it if it is defective.
4. • Replace the lid gasket if it leaks.

ERROR 46 – REPLACE THE LID GASKET (Each 500 cycles)

ERROR 48 – COMMUNICATION ERROR (This error appears in case of communication problem between display and mainboard)

1. • Check the cable between mainboard and display
2. • Replace the display.
3. • Replace the mainboard.

ERROR 49 – SMS ERROR (This error appears when SMS cannot be sent in case of any failure.)

1. • Make sure that SMS module is connected.
2. • Make sure that SMS is activated in the menu.
3. • Make sure that phone numbers are entered correctly.
4. • SMS module is defective. Replace it.
5. • Mainboard is defective. Replace it.

ERROR 50 – E-MAIL ERROR (This error appears when E-Mail cannot be sent in case of any failure.)

1. • Make sure that ethernet cable is connected and on good condition.
2. • Make sure that E-Mail is activated in the menu.
3. • Make sure that internet settings are correct in the menu.

SECTION 4
SPARE PART REPLACING

The unit should be plugged out before replacing any part.

Open the right cover for manometer, locking system and safety valve. Open the left cover for further parts.

4.1. MAINBOARD REPLACING

Figure 8

- Disconnect all the cables from mainboard terminals.
- Disconnect the display flat cable from mainboard side.
- Take out the mainboard.
- Place the new mainboard and make the connections carefully based on electrical circuit diagram.(see Section 5)
- Connect display cable back.

4.2. DISPLAY REPLACING

Figure 9

- Disconnect all the connections on the display.
- Unscrew the 2 screws on the display and take it out.
- Place the new display.
- Connect all the cables back.

4.3. REPLACING TEMPERATURE SENSORS

4.3.1. PT-1

Figure 10: PT-1 Sensor for NC90M

- Disconnect the temperature sensor cables from mainboard.
- Take out temperature sensor from bottom side of chamber by a wrench. (Figure 11)

Figure 11

- Use liquid sealing to place new temperature sensor.

**** Loxeal 53-17 should be used for liquid sealing.

☞	Pay attention connection cable not to be twisted.

- Make the connections carefully based on electrical circuit diagram.

4.3.2. PT-2

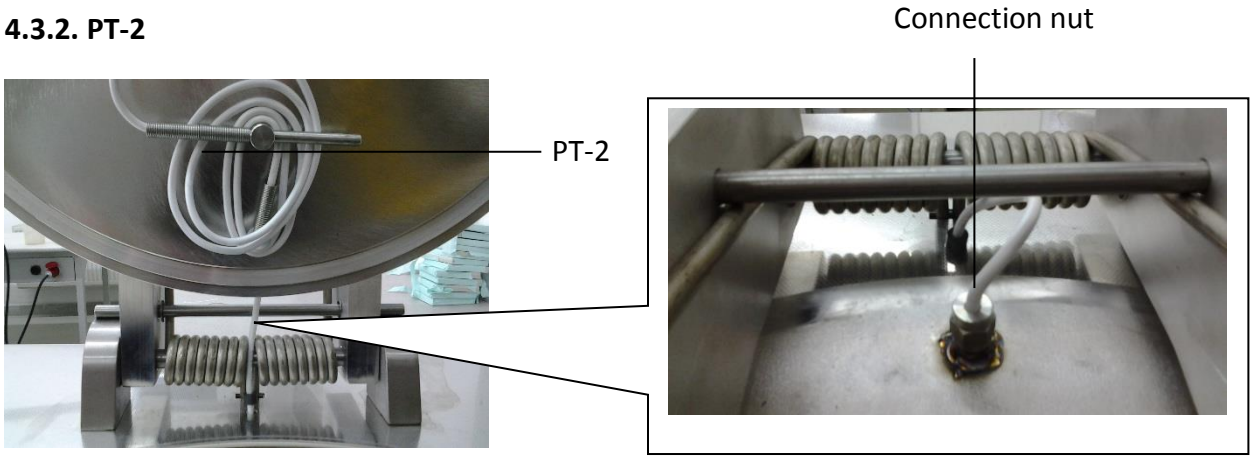

Figure 12: PT-2 Sensor

- Take out the lid cover sheet.
- Disconnect the temperature sensor cables from mainboard.

- Disconnect the temperature sensor from lid by untightening connection nut by a wrench and replace the seal.
- Place the new temperature sensor.

☞	Pay attention connection cable not to be twisted.

- Make the connections carefully based on electrical circuit diagram.

4.3.3. PT-3

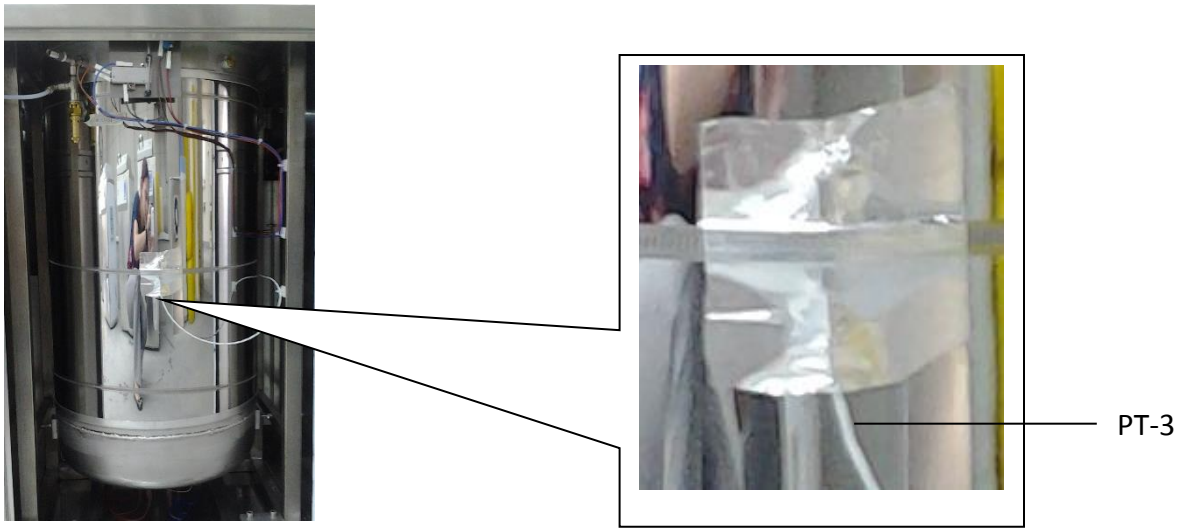

Figure 13 PT-3 Sensor

- Disconnect the temperature sensor cables from mainboard.
- Take out the temperature sensor from chamber by untightening clips. (see Figure 13)
- Place the new temperature sensor with clips.
- Make the connections carefully based on electrical circuit diagram.

4.4. SOLENOID VALVE REPLACING

- Disconnect the solenoid valve socket by unscrewing. (See Figure 14)
- Take out the solenoid valve.
- Disconnect the unions from defective solenoid valve and connect to the new solenoid valve.
- Connect the new solenoid valve.
- Connect the solenoid valve socket carefully.

Figure 14

4.5. SSR REPLACING

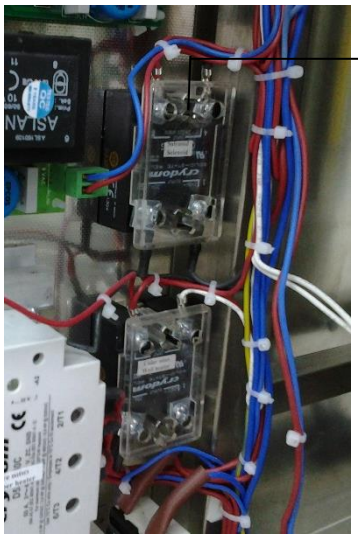

Figure 15

- Disconnect all the cables from SSR.
- Take out the SSR by unscrewing connection screws. (See Figure 15).
- Place the new SSR and make the connections carefully based on electrical circuit diagram.

4.6. SAFETY VALVE REPLACING

- Untighten the connection nut by a wrench.
- Take out the safety valve.
- Use liquid sealing to place new safety valve.
  ****Loxeal 53-17 should be used for sealing.

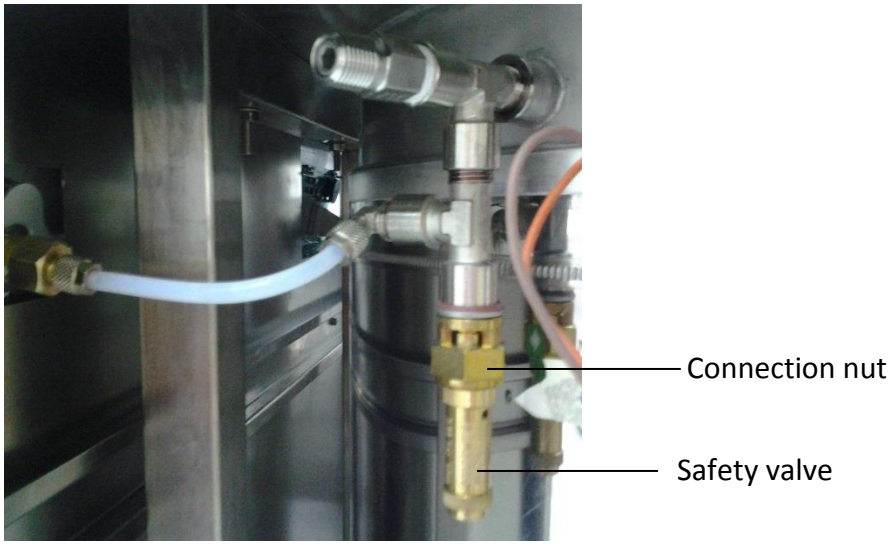

Figure 16

4.7. CHAMBER HEATERS REPLACING

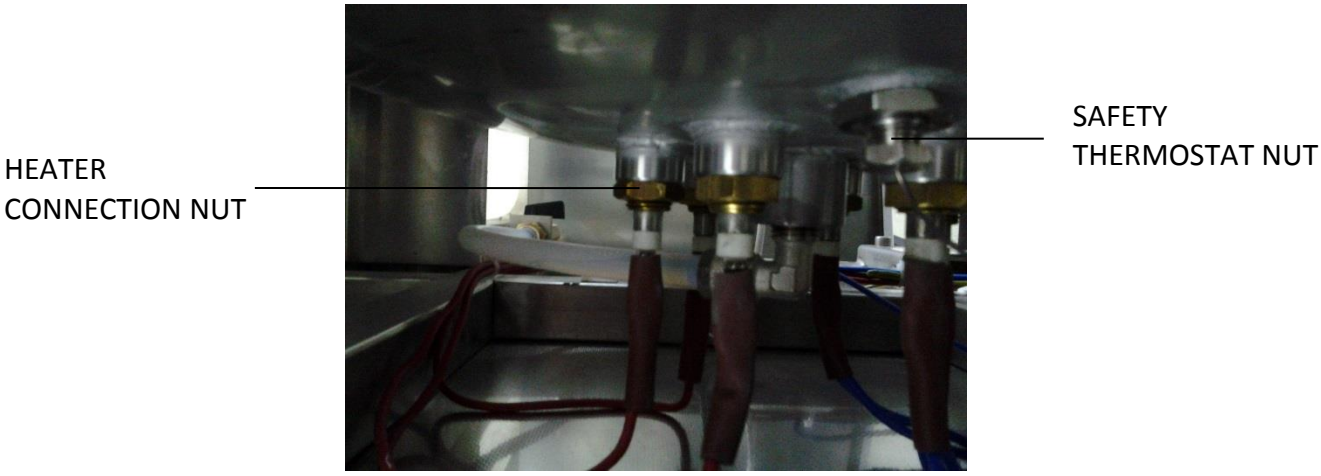

Figure 17 – Heater for NC90M

- Disconnect the heater cables.
- Unscrew the gas safety thermostat bulb clips and seperate the heater and thermostat.
- Untighten the heater connection nuts which are placed at the bottom side of the chamber.
- Place the new heaters to the chamber. (Replace heater seals)
- Place the gas safety thermostat bulb to new heaters.
- Make the cable connections carefully based on electrical circuit diagram.

4.8. CHAMBER TEMPERATURE THERMOSTAT

Figure 18

- Disconnect the cables carefully.
- Take out the chamber temperature thermostat.
- Place new chamber temperature thermostat to its place.
- Make the connections carefully based on electrical circuit diagram.

4.9. COOLING FAN REPLACING

- Disconnect the cables carefully.
- Unscrew the screws on the fan sheet and take out the fan.
- Place the new fan and connect its cables.
- Screw the sheet back to the left side of the chamber.

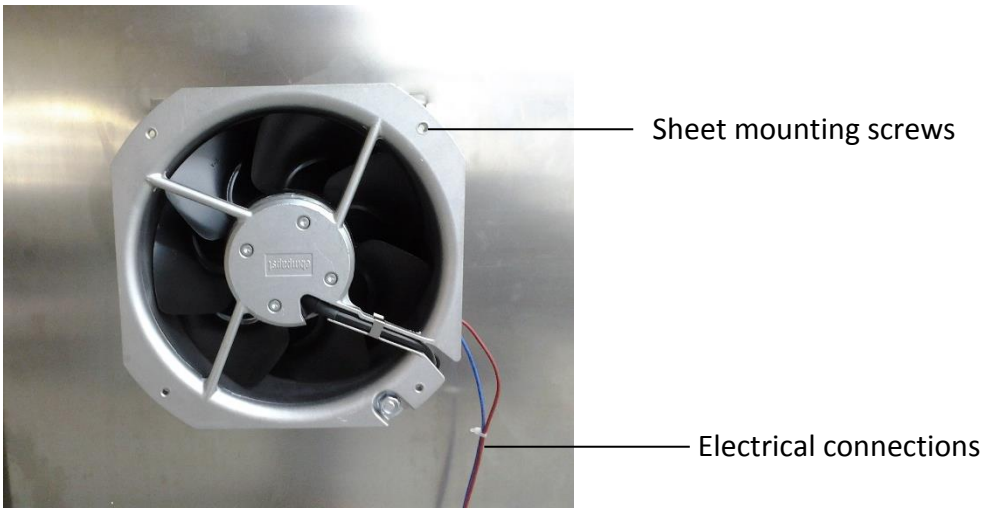

Figure 19

4.10. LOCKING RELAY REPLACING (If the locking system is like below Figure 20)

- Disconnect the cables from locking relay.
- Unscrew locking relay and take it out.
- Place the new locking relay.
- Make the connections carefully based on electrical circuit diagram.

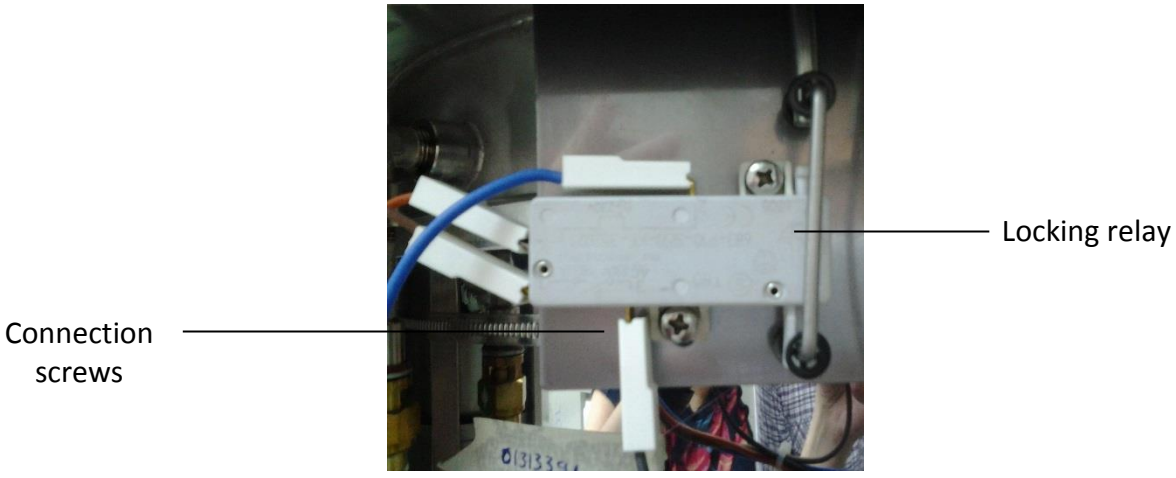

Figure 20

4.11. LOCKING COIL REPLACING (If the locking system is like below Figure 21)

- Disconnect the cables from locking coil.
- Unscrew the locking coil and take it out.
- Place the new locking coil and make the connections.

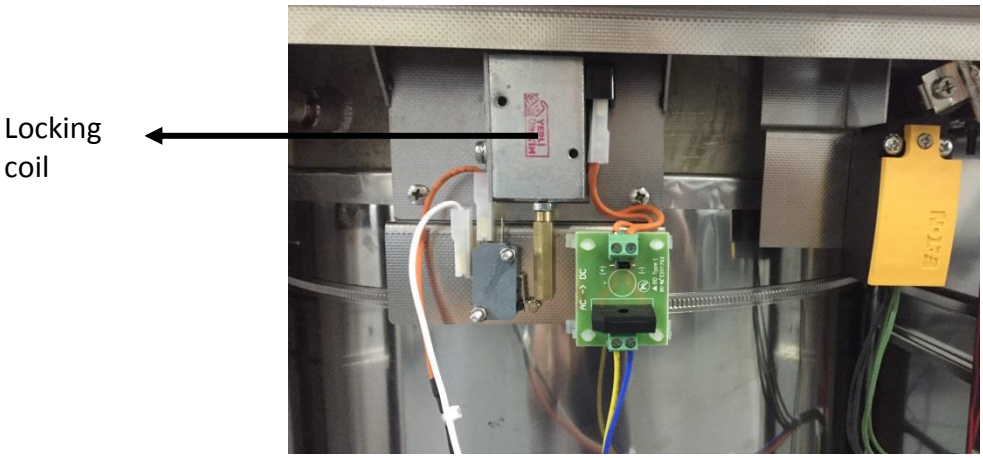

Figure 21

4.12. DOOR SWITCH REPLACING

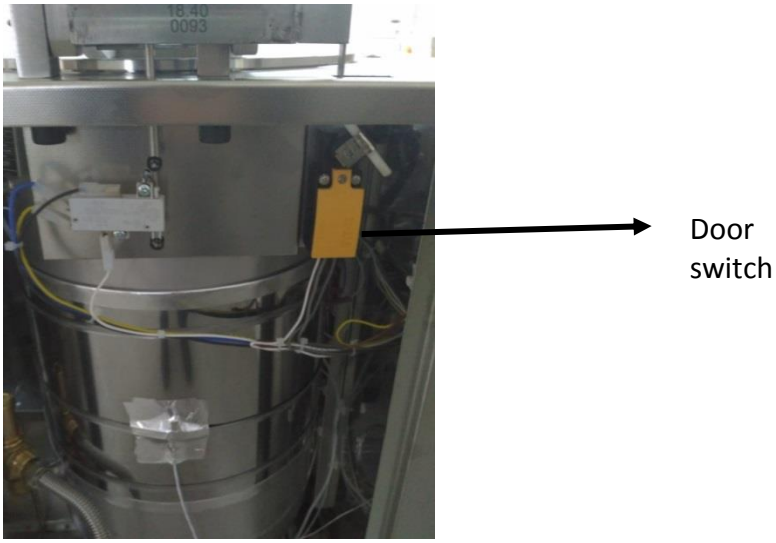

Figure 22

- Disconnect the cables from door switch.
- Take out door switch by untightening two nuts.
- Place the new door switch.
- Make the connections carefully based on electrical circuit diagram.

4.13. SURFACE THERMOSTAT REPLACING

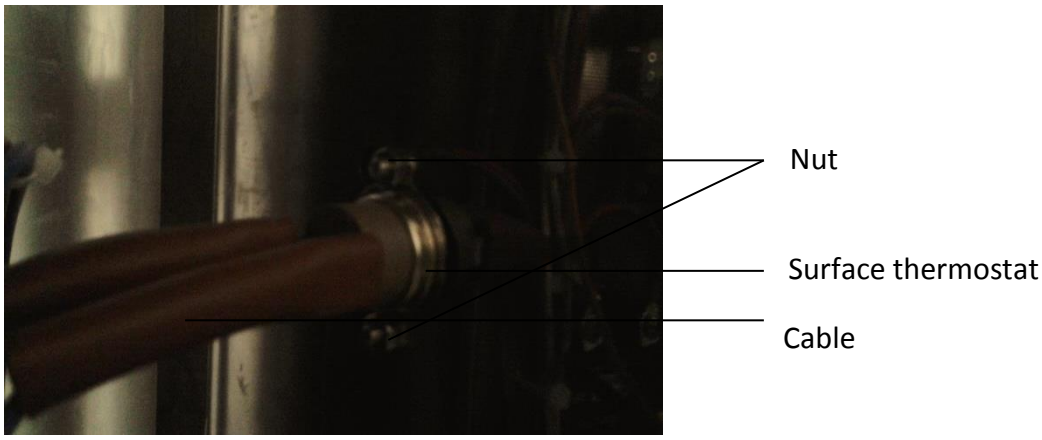

Figure 23

- Disconnect the cables carefully.
- Untighten two nuts on the surface thermostat.
- Replace surface thermostat.
- Make the connections carefully based on electrical circuit diagram.

4.14. STEAM TRAP REPLACING

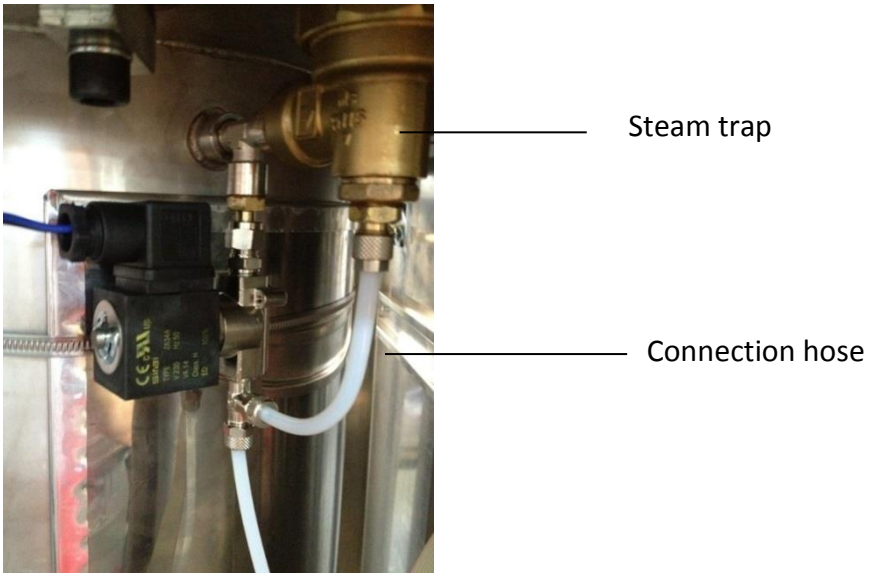

Figure 24

- Disconnect the steam trap connection hose.
- Replace the steam trap carefully.
- Connect the hose back.

4.15. JACKET HEATER REPLACING

- Disconnect the cables of jacket heater.
- Remove the two clips and take out the heater from chamber.
- Place new heater to chamber with clips.
- Make the connections carefully based on electrical circuit diagram.

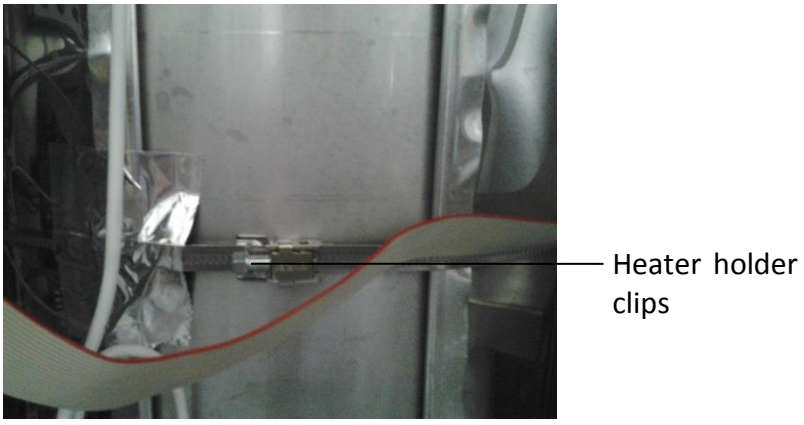

Figure 25

4.16. MANOMETER REPLACING

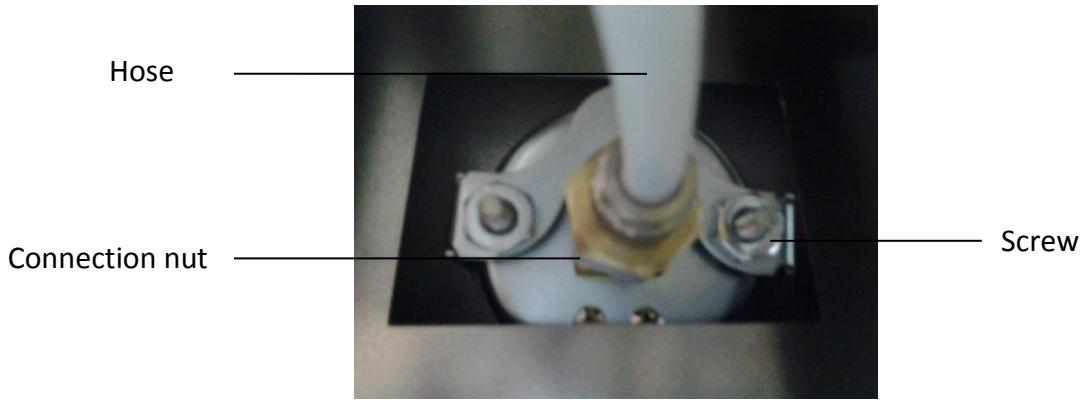

Figure 26

- Disconnect the hose by untightening connection nut.
- Unscrew the manometer
- Replace the manometer and connect the hose back.

4.17. EXHAUST TANK REPLACING

Figure 27

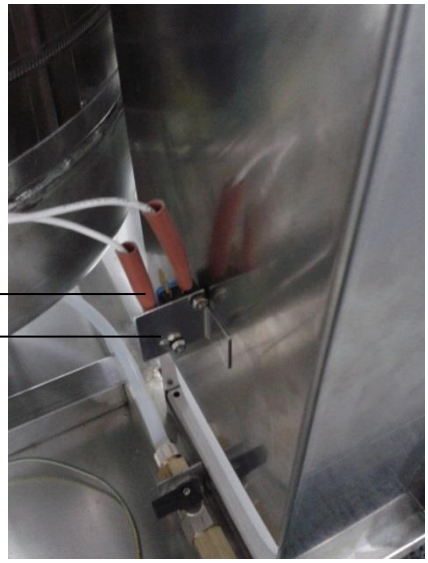

Figure 28

- Disconnect the cables.
- Unscrew the switch connection screws.
- Replace the switch.
- Make the connections carefully based on electrical circuit diagram.

SECTION 5
ELECTRICAL CIRCUIT DIAGRAM