

# OPERATION & MAINTENANCE MANUAL

**Laboratory Vertical Steam Sterilizers  
models**

**2540, 3150, 3170, 3850, 3870, 5050, 5075**

**ELV – Standard Autoclave**

**ELVC – Including Fast Cooling System**

**ELVPRC – Including Preparation for Fast Cooling System**



## TABLE OF CONTENTS

PARAGRAPH	PAGE NO.
<b>1 GENERAL</b> .....	<b>4</b>
<b>1.1 Incoming Inspection</b> .....	<b>4</b>
<b>1.2 Warranty</b> .....	<b>4</b>
<b>1.3 Warranty Statement</b> .....	<b>4</b>
<b>1.4 Ordering Information</b> .....	<b>5</b>
<b>2 SAFETY INSTRUCTIONS</b> .....	<b>6</b>
<b>3 TECHNICAL DATA</b> .....	<b>8</b>
<b>3.1 Introduction</b> .....	<b>8</b>
<b>3.2 Operating Conditions</b> .....	<b>9</b>
<b>3.3 Directives and Standards</b> .....	<b>9</b>
<b>3.4 Environment Emission Information</b> .....	<b>9</b>
<b>3.5 Electrical Data:</b> .....	<b>10</b>
<b>3.6 Specifications</b> .....	<b>10</b>
<b>3.7 Loading Capacities</b> .....	<b>11</b>
<b>3.8 Utility</b> .....	<b>11</b>
<b>3.9 Symbol Description</b> .....	<b>12</b>
<b>3.10 Water Quality</b> .....	<b>17</b>
<b>3.11 Safety Features</b> .....	<b>18</b>
<b>3.12 Description of Operation</b> .....	<b>19</b>
<b>4 STERILIZATION PROGRAMS</b> .....	<b>20</b>
<b>4.1 Program 1 – Unwrapped Instruments (1 – Instruments)</b> .....	<b>20</b>
<b>4.2 Program 2 (2- Instruments)</b> .....	<b>21</b>
<b>4.3 Program 3 (3 –Waste)</b> .....	<b>22</b>
<b>4.4 Program 4 – (4 – Liquid)</b> .....	<b>23</b>
<b>4.5 Program 5 (5- Liquid)</b> .....	<b>24</b>
<b>4.6 Program 6 (6-Liquid + Cool) – option on ELVC only</b> .....	<b>25</b>
<b>5 KEYBOARD (keys and display)</b> .....	<b>26</b>
<b>5.1 Description and Functions of the Front Panel Keyboard</b> .....	<b>27</b>
<b>5.2 Description of the Operational Messages</b> .....	<b>30</b>
<b>5.3 Displayed Error Messages and Safety Measures</b> .....	<b>32</b>
<b>6 PRINTER</b> .....	<b>34</b>
<b>6.1 Printer Operation</b> .....	<b>34</b>
<b>6.2 DPU-20 Printer Handling</b> .....	<b>36</b>
<b>6.3 DPU 30 Printer Handling</b> .....	<b>37</b>
<b>7 PREPARATION BEFORE STERILIZATION</b> .....	<b>38</b>
<b>7.1 Instruments</b> .....	<b>38</b>
<b>7.2 Tubing</b> .....	<b>39</b>
<b>7.3 Liquids</b> .....	<b>39</b>
<b>7.4 Loading</b> .....	<b>39</b>

<b>8</b>	<b>OPERATION</b> .....	<b>40</b>
	8.1 <i>Operating Instructions</i> .....	40
	8.2 <i>Moving the Autoclave</i> .....	41
	8.3 <i>Loading and Unloading the Device</i> .....	41
<b>9</b>	<b>DOOR SAFETY SYSTEM</b> .....	<b>43</b>
	9.1 <i>Solenoid locking device</i> .....	43
	9.2 <i>Door Safety System for models 5050, 5075</i> .....	43
	9.3 <i>Piston Lifting Device For 3850/3870/5050/5075 ELV</i> .....	47
<b>10</b>	<b>SERVICE AND MAINTENANCE</b> .....	<b>48</b>
	10.1 <i>Preventive Maintenance</i> .....	48
	10.2 <i>Replacing the Air Filter</i> .....	49
	10.3 <i>Replacing the Door Gasket</i> .....	50
	10.4 <i>Checking the Safety Valve</i> .....	50
	10.5 <i>Cleaning water outlet strainer</i> .....	53
<b>11</b>	<b>TROUBLESHOOTING</b> .....	<b>54</b>
<b>12</b>	<b>SPARE PARTS LIST</b> .....	<b>58</b>
<b>13</b>	<b>ACCESSORIES</b> .....	<b>58</b>

**TABLE OF CONTENT (Cont.)**

<b>DRAWINGS</b>	<b>PAGE NO.</b>
<i>Overall Dimensions 2540 ELV</i> .....	<i>13</i>
<i>Overall Dimensions Drawing for the 3150 / 3170 ELV</i> .....	<i>14</i>
<i>Overall Dimensions Drawing for the 3850 / 3870 ELV</i> .....	<i>15</i>
<i>Overall Dimensions Drawing for the 5050/ 5075 ELV</i> .....	<i>16</i>
<i>Front Panel Keyboard</i> .....	<i>26</i>
<i>Baskets and Containers</i> .....	<i>56</i>

## **1 GENERAL**

### **1.1 Incoming Inspection**

The autoclave should be unpacked and inspected for mechanical damage upon receipt. Observe packing method and retain packing materials until the unit has been inspected. Mechanical inspection involves checking for signs of physical damage such as: scratched panel surfaces, broken knobs, etc.

If damage is apparent, contact your dealer or point of purchase, so that they may notify the manufacturer and file a claim with the appropriate carrier.

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

### **1.2 Warranty**

We certify that this instrument is guaranteed to be free from defects in material and workmanship for one year against faulty components and assembly with the exception of glassware, lamps and heaters.

**The warranty does not include and does not replace routine treatment and preventive maintenance to be performed according to instructions in paragraph 10.1 (Preventive Maintenance).**

Our obligation is limited to replacing the instrument or parts, after our examination, if within one year after the date of shipment they prove to be defective. This warranty does not apply to any instrument that has been subjected to misuse, neglect, accident or improper installation or application, nor shall it extend to products that have been repaired or altered outside the factory without prior authorization from us.

**The Autoclave should not be used in a manner not described in this manual!**

### **1.3 Warranty Statement**

The warranty registration must be completed and returned to our service departments; within fourteen (14) days of purchase or the warranty will be void.

Our Technical Service Depts can be reached at:

☒ **Tuttnauer Europe** b.v., Hoeksteen 11, 4815 PR Breda, Netherlands.  
☎ +31/76-5423510,  
☐ Fax: +31/76-5423540, E-mail: [info@tuttnauer.nl](mailto:info@tuttnauer.nl)

Rudolf Gunz & Co. PTY LTD:

☒ Service Department, 26-34 Dunning Avenue, Ros, 2018, Sydney, Australia.

☒ Service Department, Locked bag 690, Beaconsfield, NSW 2014, Australia.

☎ +61-2-99356600 ☐ Fax: +61-2-99356650

**Note:**

If there is any difficulty with this instrument, and the solution is not covered in this manual, contact our representative or us first. Do not attempt to service this instrument yourself. Describe the difficulty as clearly as possible so we may be able to diagnose the problem and provide a prompt solution.

If the autoclave is equipped with a printer, send along a copy of the last printout for our inspection. If replacement parts are needed, stipulate the model and serial number of the machine.

No products will be accepted for repair without proper authorization from us. All transportation charges must be paid both ways by the owner. This warranty will be void if the unit is not purchased from an authorized full service **Tuttnauer** dealer.

**1.4 Ordering Information**

Several items must be specified when ordering the unit from the dealer.

- ◆ Exact model number (depending on desired chamber size).
- ◆ Please specify the supply voltage available, 230/380V; 1PH or 3PH.
- ◆ Temperature scale: Specify Centigrade or Fahrenheit.
- ◆ Pressure scale: Specify kPa or psi.

**1.4.1 Options**

- ◆ Printer option
- ◆ Hanging temperature control probe for use with liquids, to be placed directly inside a sample solution.
- ◆ Cooling option - specify cooling method: with or without compressed air. Air is used to balance the chamber pressure during the cooling stage.

**1.4.2 Accessories**

**Basket accessories:** A set of two baskets is available for the unit. The baskets are made of stainless steel wire and have a handle. The basket allows the operator to load a large quantity of materials into the chamber.

The pressure scale, printer option and cooling method can be set up at any time by a technician.

**Stainless steel containers:** A stainless steel container, for waste products, is available. This container has vent holes on its upper part

## **2 SAFETY INSTRUCTIONS**

The autoclave has unique characteristics. Please read and understand the operation instructions before first operation of the autoclave. The following issues may require instructions guidance provided by the manufacturer: how to operate the autoclave, the door safety mechanism, the dangers involved in circumventing safety means, how to ensure that the door is closed, and how to select a correct sterilization program.

Make sure that you know where the main power switch is, where the water cut-off valve is and where the compressed air disconnection valves (if applicable) is located.

Autoclave maintenance is crucial for the correct and efficient function of the device. We enclose a log booklet that includes maintenance recommendations, with every device.

The weekly spore test is part of the preventive maintenance plan, along with the annual validation of the sterilization processes that ensures appropriate temperature dispersion within the chamber.

Never use the autoclave to sterilize corrosive products, such as: acids, bases and phenols, volatile compounds or solutions such ethanol, methanol or chloroform nor radioactive substances.

1. Never start using a new autoclave before the safety, licensing and authorization department has approved it for use.
2. All autoclave users must receive training in proper usage from an experienced employee. Every new employee must undergo a training period under an experienced employee.
3. A written procedure must be established for autoclave operation, including: daily safety tests, seal inspection and door hinge inspection, smooth action of the closing mechanism, chamber cleaning, prevention of clogging and preservation from corrosion, what is permitted and what is prohibited for sterilization and choosing a sterilization program.
4. Liquids may be sterilized only with the "liquids" program. The container must be covered but not sealed. Sealed bottles may only be sterilized using a special program. The bottle must be either Pyrex or a Borosilicate glass bottle.
5. When sterilizing plastic materials, make sure that the item can withstand sterilization temperature. Plastic that melts in the chamber is liable to cause a great deal of damage.
6. Individual glass bottles may be placed within an appropriate container that will be placed in a basket. Never place glass bottles on the floor of the autoclave. Never fill more than 2/3 of the bottle volume.
7. On closing the autoclave's door, make sure it is properly locked before activating.
8. Before withdrawing baskets, wear heat resistant gloves.
9. Before opening the door, verify that there is no pressure in the chamber (chamber pressure gauge is located on the autoclave's front panel or door, depends on model).
10. Open the door slowly to allow steam to escape and wait 5 minutes before you remove the load. When sterilizing liquids, wait 10 minutes.

11. Once a month, ensure that the safety valves are functioning, and once annually a certified tester must conduct pressure chamber safety tests.
12. Once annually, or more frequently, effective tests must be performed, i.e., calibration and validation.
13. Examine the condition of assemblies on a regular basis. Make sure there are no leaks, breaks, blockages, whistles or strange noises.
14. It is required to conduct maintenance operations as instructed.
15. Immediately notify the person in charge of any deviation or risk for the proper function of the device.



### 3 **TECHNICAL DATA**

#### 3.1 **Introduction**

Models 2540, 3150, 3170, 3850, 3870, 5050 and 5075, 5090 ELV are vertical sterilizers designed especially for sterilization of instruments, liquids and other materials in hospital laboratories, medical laboratories, research institutes, food laboratories and pharmaceutical facilities.

A special feature of this sterilizer is the fast cooling operation, provided as an option for the liquids sterilization cycle.

The sterilizer is fully automatic with a choice of six programs, eliminating any need for operator intervention during a cycle. The sixth program is an optional program including a cooling stage (program 7 is for leakage test only). A computerized control unit enables precise control and monitoring of physical parameters and clear documentation of the sterilization cycles.

The autoclave is equipped with a safety valve, which blows off at an overpressure of over 25 psi, which is located on the rear of the autoclave. The control system provides adequate protection, to ensure the safety of personnel and reliable operation with a minimum of down time.

On all models (except 1730), a printer is an optional addition to the autoclave. The printer prints the preset and actual parameters of the cycle (temperature, time and pressure/vacuum).

The autoclave is equipped with a pressure gauge designed for reference only. In case that there is any problem with electricity supply during a sterilization cycle the pressure gauge will be used to verify that there is pressure in the chamber.

This manual provides information for the following models:

- ◆ ELV – this is the basic model of the vertical laboratory autoclave.
- ◆ ELVC – this model includes a cooling system that enables cycles with fast cooling.
- ◆ ELVPRC – this model includes only the cooling coil as a preparation for a cooling system but performs as ELV. A Tuttnauer technician can upgrade this model to ELVC.

This manual is intended to give the user a general understanding of how the autoclave works and indicates best ways to operate and maintain it in order to obtain optimum results and a trouble free operation.

After reading this manual, operating the autoclave should be straight forward. However, since the autoclave is built using high technology sensitive components, no attempt should be made by the user or any other unauthorized person to repair or re-calibrate it.

Only technical personnel having proper qualifications, holding technical documentation and adequate test instrumentation, are authorized to undertake repair or service.

### 3.2 *Operating Conditions*

- ◆ The autoclave is intended to work in 'indoor' conditions only.
- ◆ Only autoclavable materials shall be used.
- ◆ The ambient temperature shall not exceed 40°C and a relative humidity up to 85%.
- ◆ The autoclave shall not be used in a manner not specified in this manual!
- ◆ Do not use the autoclave in the presence of dangerous gases.
- ◆ The packed or unpacked device shall be stored in 'indoor' conditions.

#### **Caution**

**Waste water should be brought into the public net in accordance with the local rules or requirements i.e. only non-hazardous liquids shall be disposed in public sewage!**



### 3.3 *Directives and Standards*

Every autoclave meets the provisions of the following Directives and is constructed in compliance with the following Standards:

#### **3.3.1 *Technical Directives***

1. Pressure Equipment Directive 97/23/EC.
2. Council Directive for voltage limits 73/23/EEC.
3. Electromagnetic Compatibility Requirements Directive 89/336/EC.

#### **3.3.2 *Technical Standards***

1. ASME code (models 2540, 3150, 3850, 3870).
2. EN 13445 (models 5050, 5075).
3. IEC-61010-1 & IEC-61010-2-040 - Safety requirements for medical device.
4. EN 61326 – EMC Requirements .

#### **3.3.3 *Quality standards***

The manufacturing plant meets the following quality standards:

1. EN ISO 9001:2008– Quality System
2. ISO 13485:2003 – Quality systems – Medical devices.

### 3.4 *Environment Emission Information*

- A. Peak sound level generated by the sterilizer is « 70 / dBA with a back sound level of 60 dBA.
- B. Total heat transmitted by the sterilizer is < 100 W/h

### 3.5 *Electrical Data:*

	<b>2540</b>	<b>3150</b>	<b>3170</b>	<b>3850</b>	<b>3870</b>	<b>5050</b>	<b>5075</b>
* Ampere (A) at 1Ph/230V/50/60 Hz	10.4	14.3	14.3	26	26	39	39
Ampere (A) at 3Ph/380V/50/60 Hz	—	—	—	8.7	8.7	13.0	13.0
Ampere (A) at 3Ph/230V/50/60 Hz	—	—	—	17	17	23	23
Ampere (A) at 3Ph/208V/50/60 Hz	—	—	—	17	17	23	23
Watts (W)	2400	3300	3300	6000	6000	9000	9000
Protection against electrical shock	Class I						

\*Models 3850/70, 5050/75 are equipped with a switching box for 1 or 2 h to 3Ph

### 3.6 *Specifications*

#### 3.6.1 *Dimensions*

<b>DIMENSIONS</b>		<b>MODEL</b>						
		<b>2540</b>	<b>3150</b>	<b>3170</b>	<b>3850</b>	<b>3870</b>	<b>5050</b>	<b>5075</b>
Chamber diameter in mm.		250	310	310	380	380	500	500
Chamber depth in mm.		400	550	730	480	680	520	750
Chamber volume (lit.)		23	40	59	65	85	110	160
Overall dimensions	Height (mm)	665	780	960	760	960	770	1000
	Width (mm)	500	580	580	650	650	700	700
	Length (mm.)	335	420	420	500	500	880	880

#### 3.6.2 *Technical Data*

<b>PROPERTY</b>	<b>MODEL</b>						
	<b>2540</b>	<b>3150</b>	<b>3170</b>	<b>3850</b>	<b>3870</b>	<b>5050</b>	<b>5075</b>
Chamber material	St. St. 316 Ti (1.4571)	St. St. 316 Ti (1.4571)	St. St. 316 Ti (1.4571)	St. St. 316 Ti (1.4571)	St. St. 316 Ti (1.4571)	St. St. 316 Ti (1.4571)	St. St. 316 Ti (1.4571)
Door material	ST.ST. 304L	ST.ST. 304L	ST.ST. 304L	ST.ST. 304L	ST.ST. 304L	St. St. 316 Ti (1.4571)	St. St. 316 Ti (1.4571)
Air supply pressure to be regulated (Bar)	3-8	3-8	3-8	3-8	3-8	3-8	3-8
Feed water pressure To be regulated (Bar)	2-3	2-3	2-3	2-3	2-3	2-3	2-3
Net weight (kg)	48	45	53	85	100	171	190
Shipping volume (m <sup>3</sup> )	0.21	0.56	0.56	0.56	0.56	1.35	1.35
Shipping weight (kg)	57	85	93	101	116	204	223

Chamber insulation - Fiber glass with reinforced material

Outer Cabinet - Stainless Steel

### 3.7 Loading Capacities

#### 3.7.1 Erlenmeyer Flasks

SIZE	2540	3150	3170	3850	3870	5050	5075
250 ml	2 x 4	3 x 7	3 x 7	2 x 12	3 x 12	2 x 21	3 x 21
500 ml	1 x 2	2 x 4	3 x 4	2 x 8	3 x 8	2 x 14	3 x 14
1000 ml	1	2 x 2	3 x 2	1 x 5	2 x 5	2 x 8	3 x 8
2000 ml	1	1	2 x 1	1x2	2 x 2	1x5	2 x 5
3000 ml	1	1	2 x 1	1	2 x 1	1x4	2 x 4
5000 ml	—	1	1	1	1	1x2	1x2

#### 3.7.2 Medium Flasks (Schott)

SIZE	2540	3150	3170	3850	3870	5050	5075
250 ml.	2 x 7	3 x 11	3 x 11	2 x 19	3 x 19	2 x 32	3 x 32
500 ml	1 x 4	2 x 7	3 x 7	2 x 12	3 x 12	2 x 21	3 x 21
1000 ml	1x3	1 x 5	2 x 5	1 x 8	2 x 8	2 x 15	3 x 15
2000 ml	1	31x2	2 x 2	1x4	2 x 4	1x8	2 x 8
5000 ml	1	1	1	1	1	1x4	2 x 4

### 3.8 Utility

Utility		Power	Recommended Circuit Breaker
Power Supply	2540	1Ph, 230V/50/60Hz	20A
	3150/70	1 or 2 Ph, 230V/50/60Hz	25A
	3850/70	3 Ph, 208V/50/60Hz	25A
	3850/70	3 Ph, 230V/50/60Hz	25A
	3850/70 with switching box	1 or 2 Ph, 230V/50/60Hz	30A
	3850/70, 5050/75	3 Ph, 400V/50/60Hz	20A
	5050/75	3 Ph, 208V/50/60Hz	30A
	5050/75	3 Ph, 230V/50/60Hz	30A
	5050/75 with switching box	1 or 2 Ph, 230V/50/60Hz	45A
Compressed Air (ELVC models only)		1/2" 3-4 Bar	
Tap water		1/2", 2-3 Bar	
Mineral free water		1/2", 2-4 Bar	
Drain		Withstanding temp. of 80°C	



#### Attention:

The electrical net must be protected with a current leakage safety relay.  
The electrical network must comply with local rules or regulations.

3.9 *Symbol Description*



**Caution! Consult accompanying documents**



**Caution! Hot surface.**



**Caution! Hot steam.**

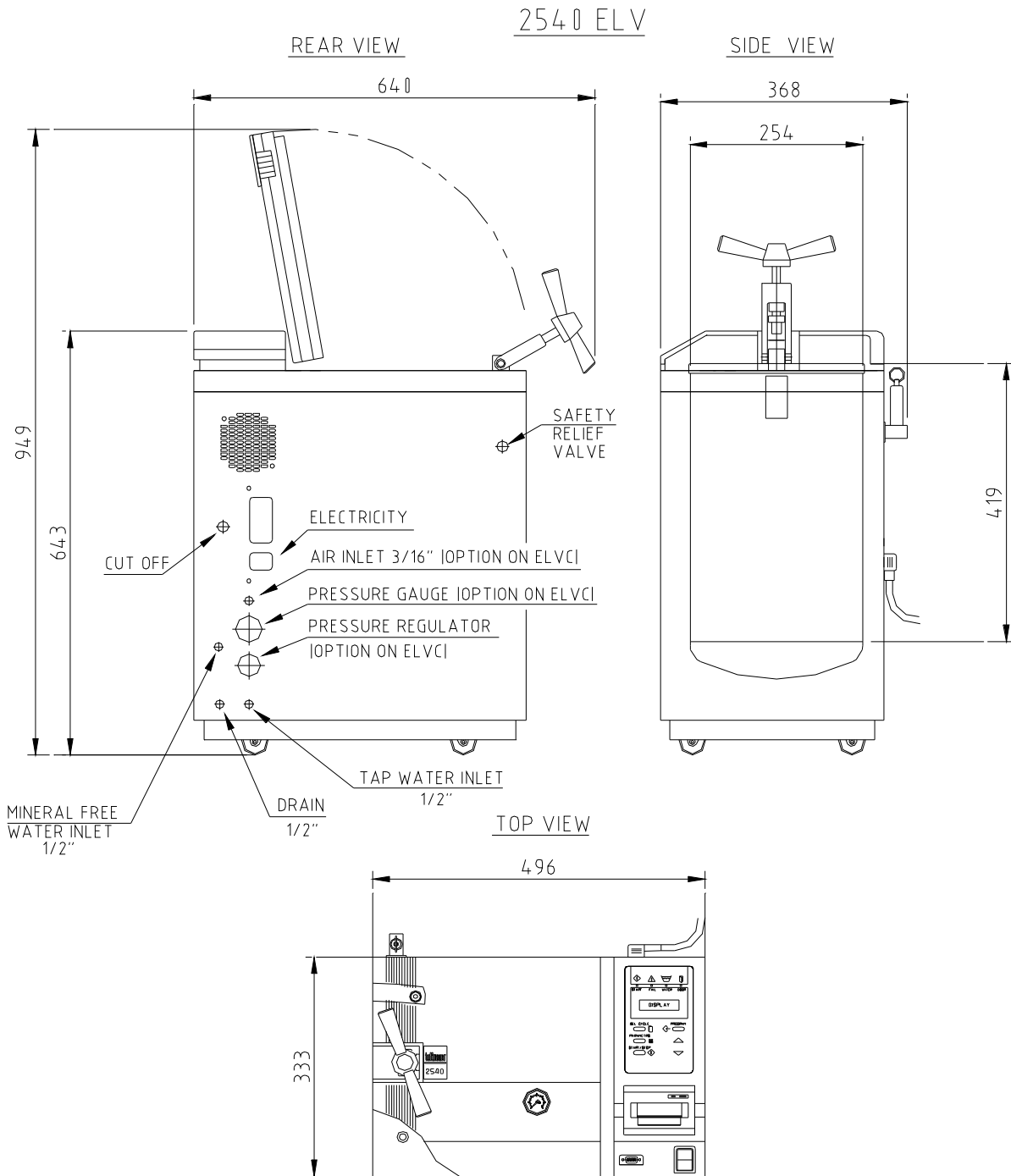


**Protective earth (Ground)**



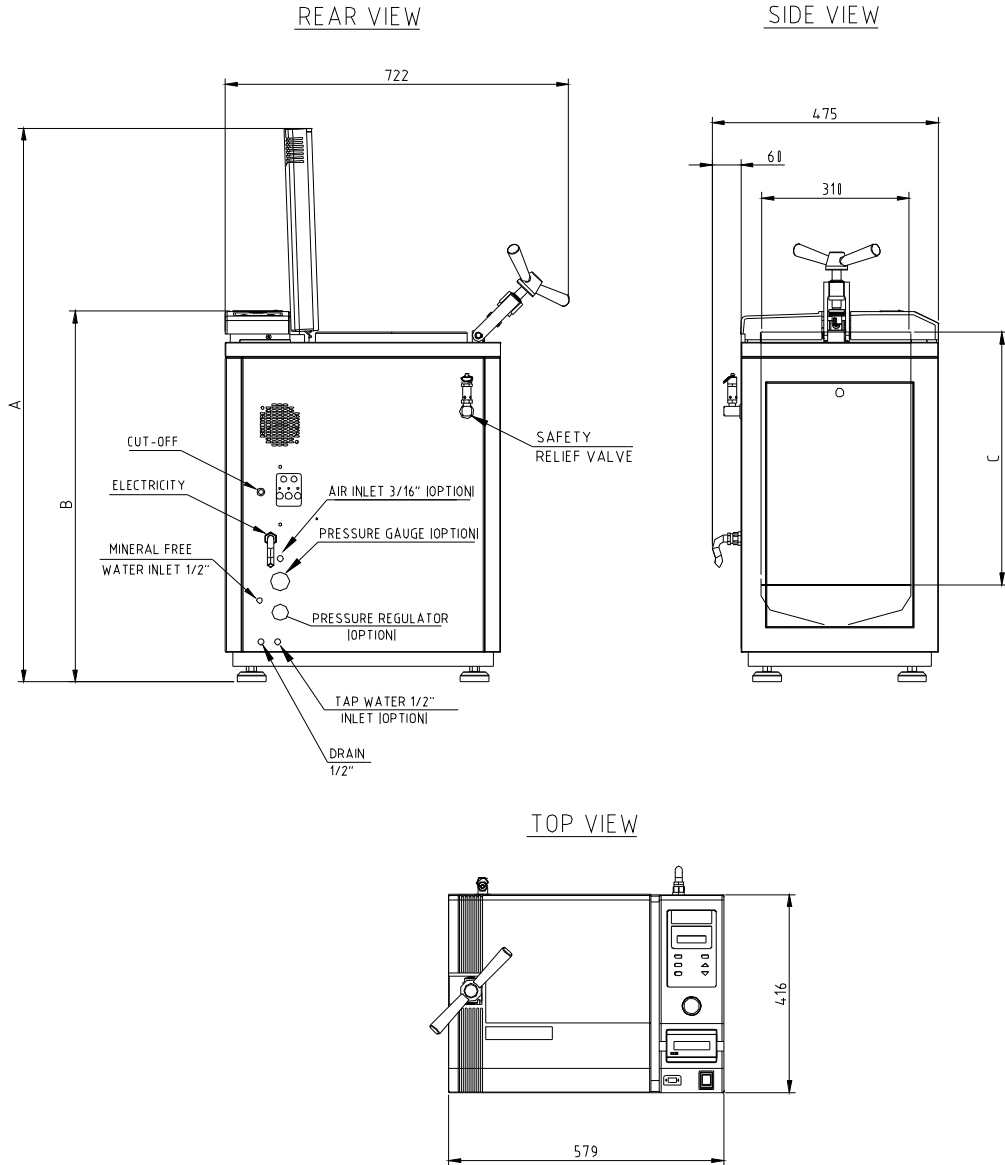
**On-Off**

**OVERALL DIMENSIONS 2540 ELV**



**OVERALL DIMENSIONS DRAWING FOR THE 3150 / 3170 ELV**

3150 / 3170 ELV

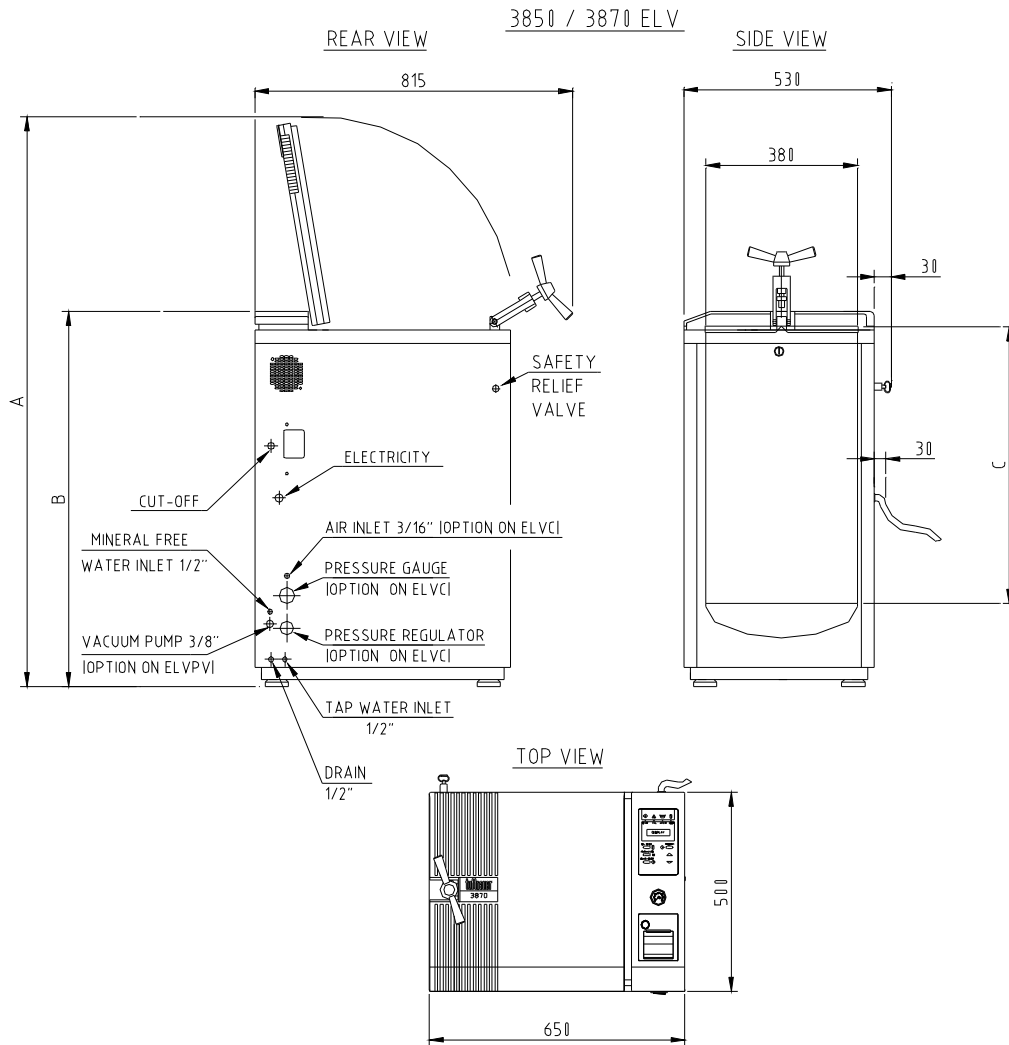


**Note:**

The dimensions A, B and C are different for the models 3150 and 3170, as indicated below

<b>TYPE</b>	<b>A</b>	<b>B</b>	<b>C</b>
<b>3150</b>	1165	780	530
<b>3170</b>	1345	960	710

**OVERALL DIMENSIONS DRAWING FOR THE 3850 / 3870 ELV**



**Note:**

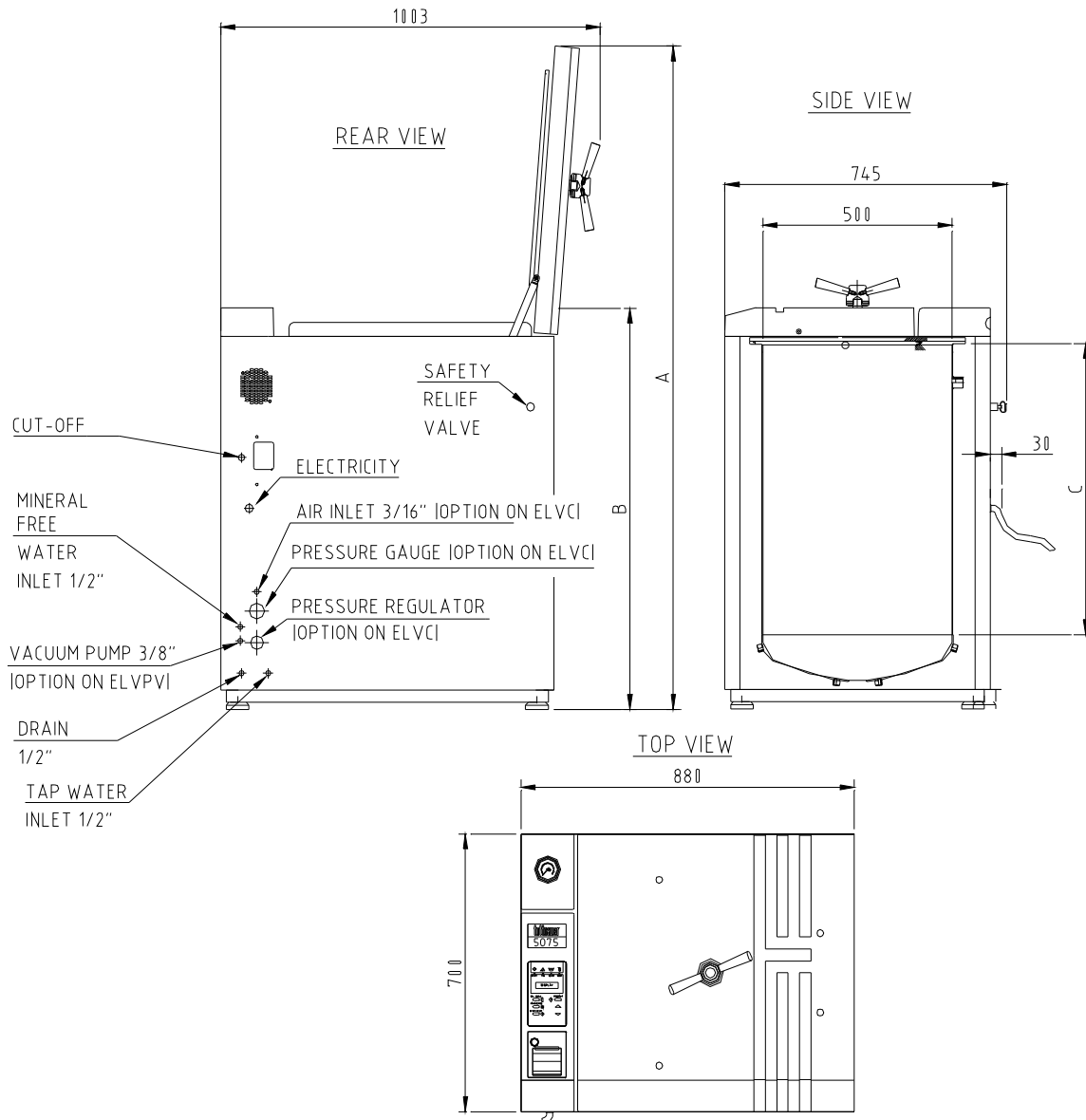
The dimensions A, B and C are different for the models 3850 and 3870, as indicated below

TYPE	A	B	C
3850	1220	745	500
3870	1400	925	680



**OVERALL DIMENSIONS DRAWING FOR THE 5050/ 5075 ELV**

5050 / 5075 ELV



**Note:**

The dimensions A, B and C are different for the models 5050 and 5075, as indicated below

TYPE	A	B	C
<b>5050</b>	1440	780	503
<b>5075</b>	1670	1010	733

### 3.10 Water Quality

#### 3.10.1 Water for Steam Generation

The distilled or mineral – free water supplied to the autoclave should have the physical characteristics and maximum acceptable level of contaminants indicated in the table below:

**Physical Characteristics and Maximum acceptable contaminants levels in steam for sterilizers (According to EN 13060:2004).**

Element	Condensate – allowable content
Silicium oxide. SiO <sub>2</sub>	≤0.1 mg/kg
Iron	≤0.1 mg/kg
Cadmium	≤0.005 mg/kg
Lead	≤ 0.05 mg/kg
Rest of metals except iron, cadmium, lead	≤0.1 mg/kg
Chloride (Cl)	≤0.1 mg/kg
Phosphate (P <sub>2</sub> O <sub>5</sub> )	≤0.1 mg/kg
Conductivity (at 20°C)	≤3 µs/cm
pH value (degree of acidity)	5 to 7
Appearance	Colourless clean without sediment
Hardness (Σ Ions of alkaline earth)	≤0.02 mmol/l

Compliance with the above data should be tested in accordance with acknowledged analytical methods, by an authorized laboratory.



**Attention:**

*We recommend testing the water quality once a month. The use of water for autoclaves that does not comply with the table above may have severe impact on the working life of the sterilizer and can invalidate the manufacturer's guarantee.*

#### 3.10.2 Drain Cooling

The feed water supplied to the drain cooling must meet the following requirements:

- ◆ Hardness: 0.7 - 0.2 mmol/l.
- ◆ Water temperature shall not exceed 15°C.

### **3.10.3 Reverse Osmosis**

A Reverse Osmosis (RO) system may be used to improve the quality of the water used to generate steam in the autoclave chamber.

In RO, the water is forced through a semi-penetrable membrane, which filters out contaminants to a high degree of efficiency. In deionisation (DI) ions and charged particles are removed either by electric fields or by ion exchange in resin beds.

Although the RO cannot normally attain the degree of purity possible with the DI methods, it is more than adequate for the feed water intended for clean-steam generators.

Moreover the RO has several advantages:

1. RO is cheaper to install and to run than DI.
2. RO removes particulate matter, organic molecules and pyrogens that DI cannot remove
3. RO water is less corrosive to steel and copper than DI water.
4. RO maintenance requirements are less demanding than those of the DI units.

Therefore the use of mineral free water will contribute to better performance and longer life of the autoclave.

### **3.11 Safety Features**

This autoclave includes built-in safety features such as:

- ◆ Error message display.
- ◆ Temperature dependent door locking according to European standards.
- ◆ Electronic pressure and temperature measurement.
- ◆ Safety relief valve to avoid build-up of excessive pressure.
- ◆ Door switch enabling operation to be started only when the door is closed.
- ◆ Water level safety device.
- ◆ Excess temperature protection.

### **3.12 Description of Operation**

#### **3.12.1 Heat**

The ELV vertical autoclaves are equipped with immersion type, heating elements. After water has been introduced to the chamber and the unit has been activated, the heating elements begin to heat. The temperature and pressure in the chamber increase until appropriate levels are reached. Sensors located inside the chamber control the temperature and pressure levels.

#### **3.12.2 Sterilization**

The sterilization temperature is factory set at 134°C (273°F) for instruments and at 121°C (250°F) and 105°C (221°F) for liquids and other materials for which this temperature is appropriate. These settings may be modified before each cycle. When sterilization temperature is reached, the timed sterilization cycle begins.

#### **3.12.3 Exhaust**

When the timed sterilization cycle is complete, the unit enters into the exhaust stage, provided that a program other than the liquid program was selected. The steam is exhausted from the chamber, bringing the internal pressure down to atmospheric pressure.

#### **3.12.4 Cooling**

The autoclave is designed to operate two liquid cooling cycles, as follows:

##### **3.12.5 Sealed bottles (cooling with compressed air)**

On completion of the sterilization stage, feed water starts flowing through the cooling coil mounted around the outer side of the chamber.

Compressed air is injected inside the chamber and keeps a constant air pressure to balance the internal pressure of the liquids inside the bottles. Compressed air is passed through a 0.2µ microbiological filter. When temperature of the liquids reaches the final set temperature, the cooling stage is completed, flowing water and compressed air is stopped, pressure in the chamber goes down to atmospheric pressure.

At this stage, the door of the autoclave can be opened and the sterilized materials can be taken out of the chamber.

##### **3.12.6 Unsealed bottles (cooling without compressed air)**

On completion of sterilization, steam is exhausted from the chamber at a slow rate. When chamber pressure goes down to atmospheric pressure, water starts flowing through the cooling coil mounted around the outer side of the chamber. On conclusion of the cycle the water flow is stopped automatically, process is completed and it is possible to open the door and take out the sterilized goods from the chamber.

## 4 **STERILIZATION PROGRAMS**

The autoclave offers 6 sterilization programs without drying +1 test program.

### 4.1 **Program 1 – Unwrapped Instruments (1 – Instruments)**

Program 1 is recommended for sterilizing unwrapped instruments and materials for immediate use and preventing cross infection at temperature 134°C.

#### **Nominal Parameters**

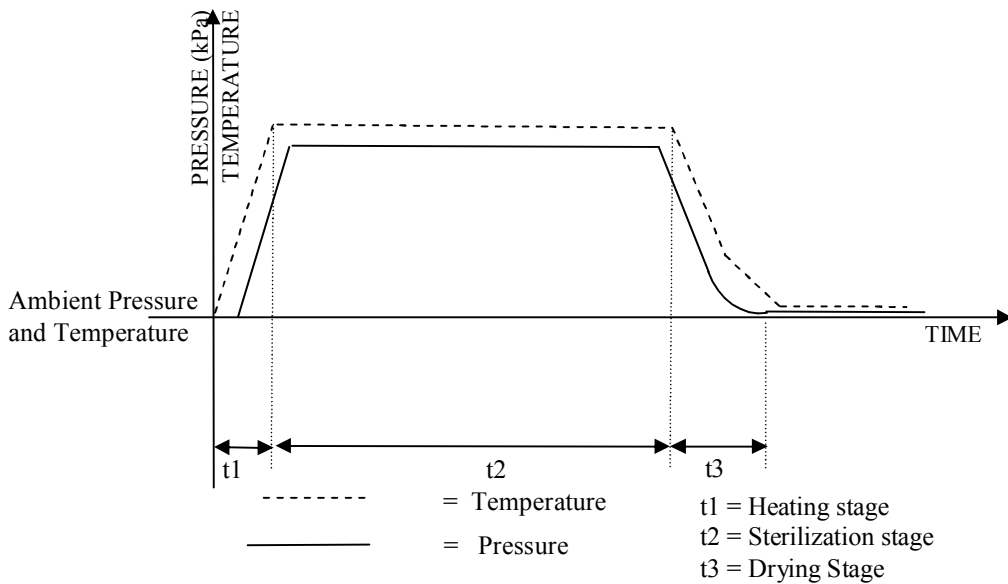
- ◆ Sterilization temperature: 134°C (273°F)
- ◆ Sterilization time: 3 mins.

#### **Operations Sequence**

- ◆ Heating phase; water enters the chamber and warms up until the sterilization temperature is reached.
- ◆ Fast exhaust phase (Ex. Mode=1); steam is rapidly exhausted from the chamber, until pressure equalizes atmospheric pressure.

#### **Note:**

**The sterility of instruments processed in unwrapped cycles cannot be maintained if exposed to non-sterile environment.**



#### 4.2 Program 2 (2- Instruments)

Program 2 is recommended for sterilizing unwrapped instruments and materials for immediate use and preventing cross infection at temperatures of 121°C.

##### Nominal parameters

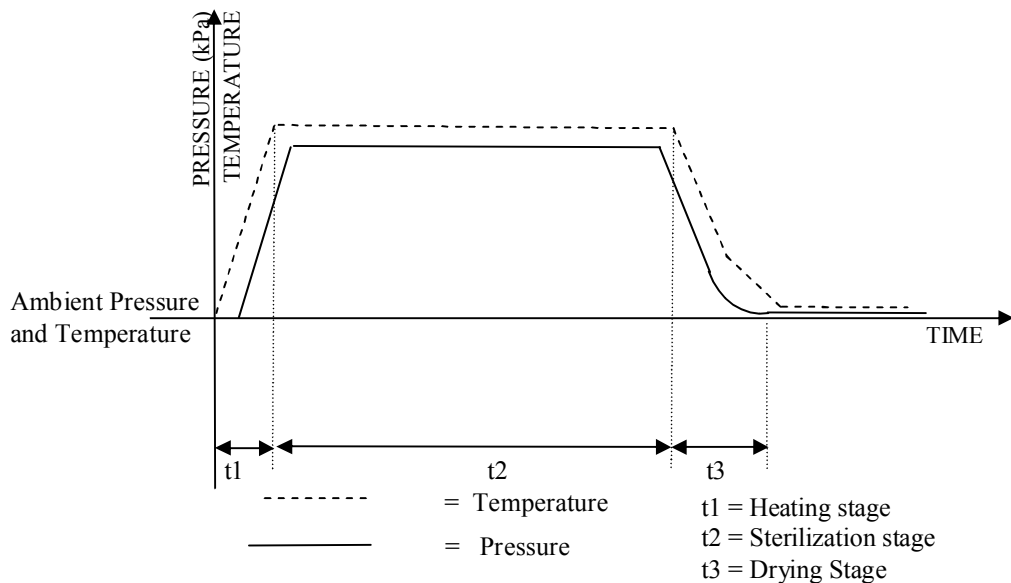
- ◆ Sterilization temperature: 121°C (250°F).
- ◆ Sterilization time: 15 mins.

##### Operations Sequence

- ◆ Heating phase; water enters the chamber and warms up until the sterilization temperature is reached.
- ◆ Sterilization phase; temperature is maintained constant at the preset level for the sterilization time.
- ◆ Fast exhaust phase (Ex Mode=1); steam is rapidly exhausted from the chamber, until pressure equalizes atmospheric pressure.



**Note:**  
The sterility of instruments processed in unwrapped cycles cannot be maintained if exposed to non-sterile environment.



#### 4.3 Program 3 (3 – Waste)

For waste materials when the manufacturer recommends autoclaving at a temperature of 121°C.

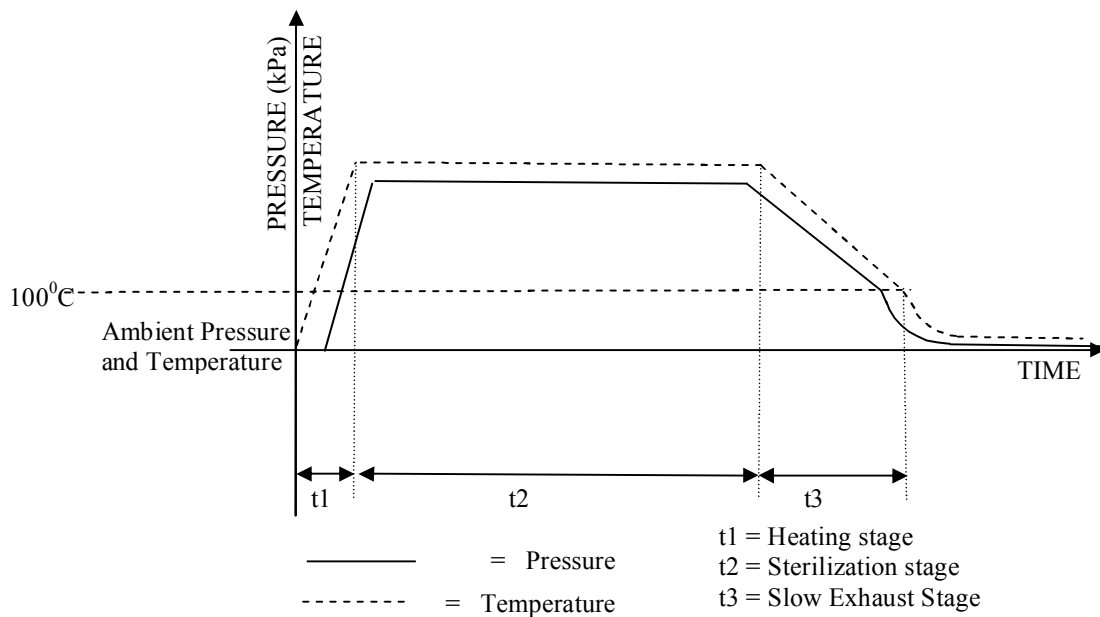
##### Nominal Parameters

- ◆ Sterilization temp.: 121°C (250°F)
- ◆ Sterilization time: 20 mins.

##### Operations Sequence

- ◆ Heating phase; water enters the chamber and heats up until the sterilization temperature is reached.
- ◆ Sterilization phase; temperature is maintained constant at the preset level for the sterilization time.
- ◆ Slow exhaust (Ex. Mode =3); steam is slowly exhausted from the chamber, until it reaches a temperature of 100°C. At this point the exhaust valve is opened.

The options available are described in paragraph 2. (Technical data).



#### 4.4 Program 4 – (4 – Liquid)

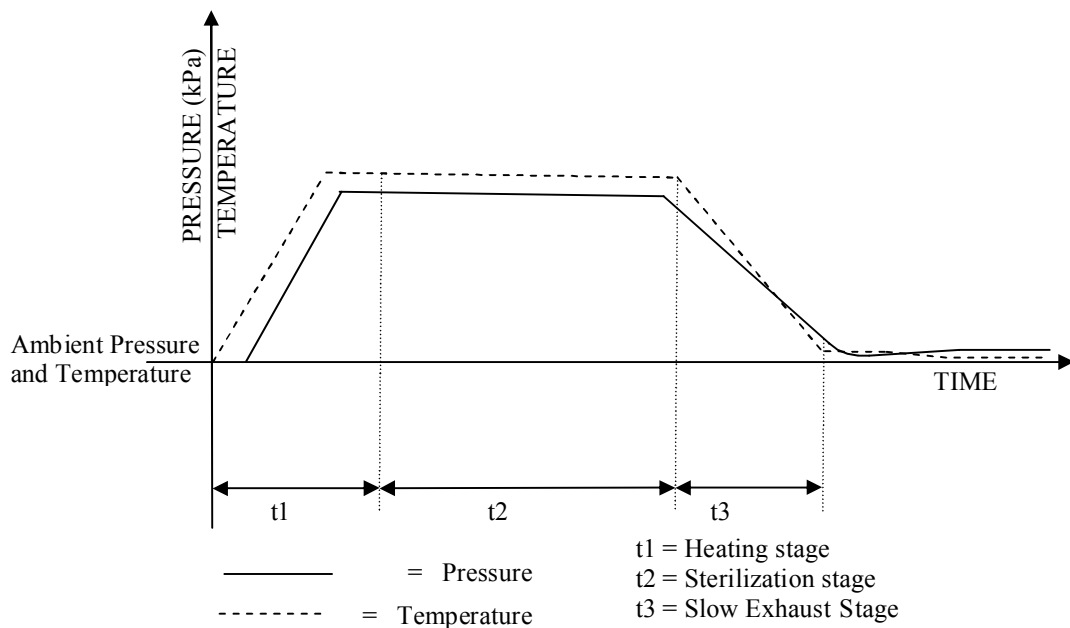
For liquids when the manufacturer recommends autoclaving at temperatures of 121°C with no drying cycle.

##### Nominal Parameters

- ◆ Sterilization temperature: 121°C (250°F).
- ◆ Sterilization time: 20 mins.

##### Operations Sequence

- ◆ Heating phase; The water enters the chamber and heats up until the sterilization temperature is reached.
- ◆ Sterilization phase; temperature is maintained constant at preset level for the sterilization time.
- ◆ Slow exhaust phase (Ex. Mode=4); steam is slowly exhausted from the chamber, until it reaches the required temperature of around 85°C and the pressure equals the atmospheric pressure.





#### 4.5 Program 5 (5- Liquid)

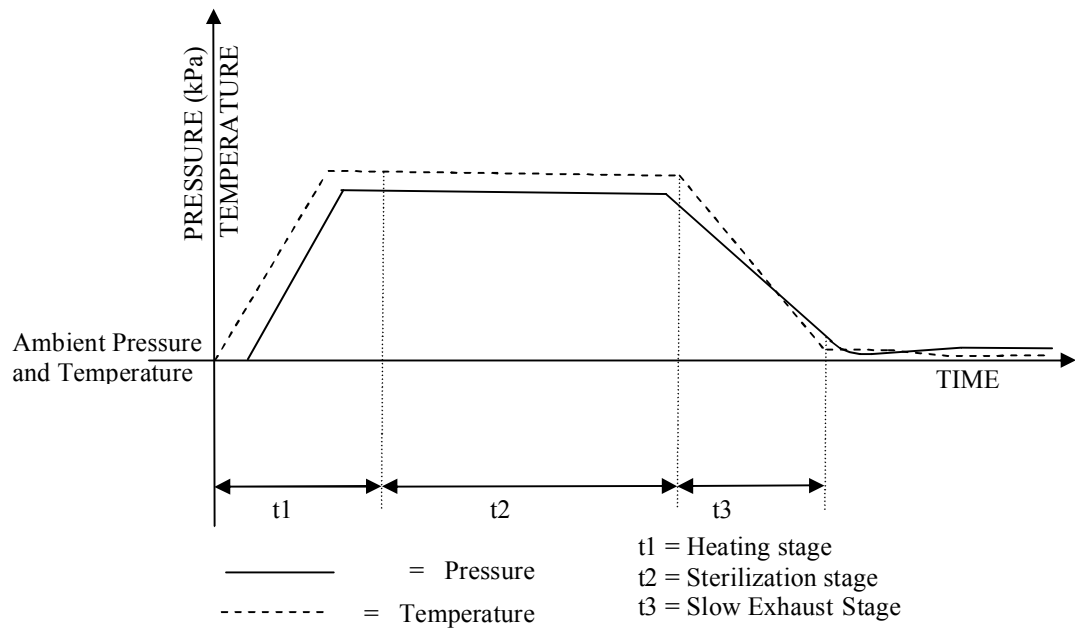
For liquids when the manufacturer recommends autoclaving at temperatures of 105°C with no drying cycle.

##### Nominal Parameters

- ◆ Temperature: 105°C (225°F).
- ◆ Time: 18 mins.

##### Operations Sequence

- ◆ Heating phase; The water enters the chamber and heats up until the sterilization temperature is reached.
- ◆ Sterilization phase; temperature is maintained constant at the preset level for the sterilization time.
- ◆ Slow exhaust phase (Ex. Mode = 4); steam is slowly exhausted from the chamber, until it reaches the required temperature of approximately 85°C and the pressure equals the atmospheric pressure.



#### 4.6 Program 6 (6-Liquid + Cool) – option on ELVC only

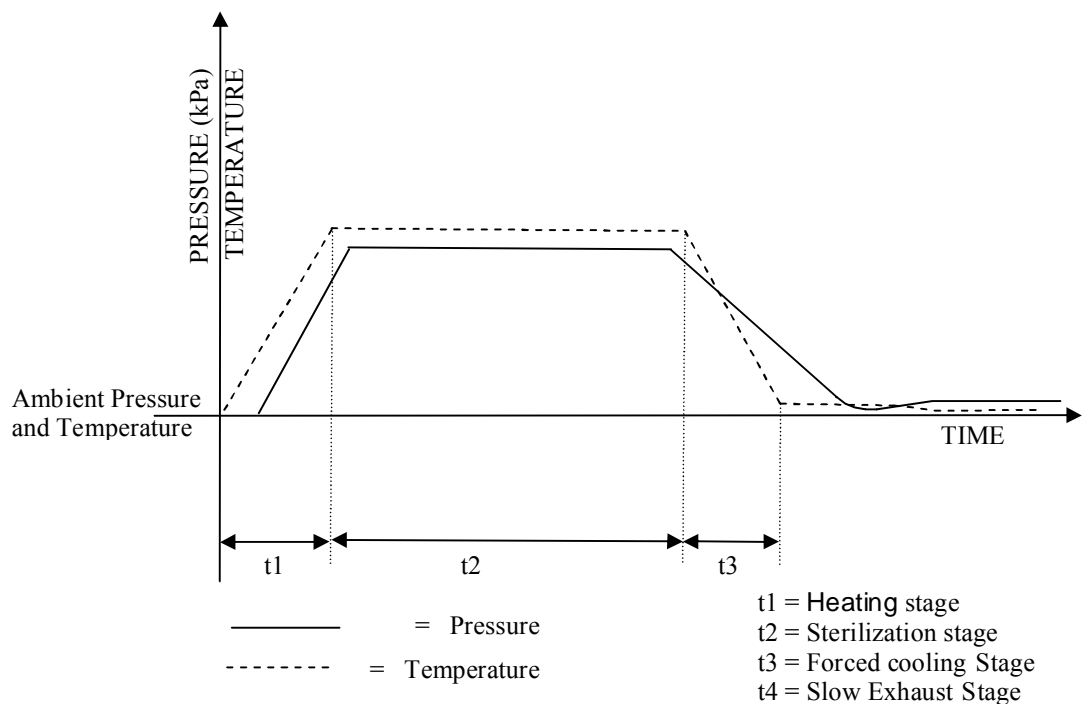
For materials when the manufacturer recommends sterilization to temperatures of 121°C with no drying cycle.

##### Nominal Parameters

- ◆ Sterilization temperature: 121°C (250°F).
- ◆ Sterilization time: 30 mins.

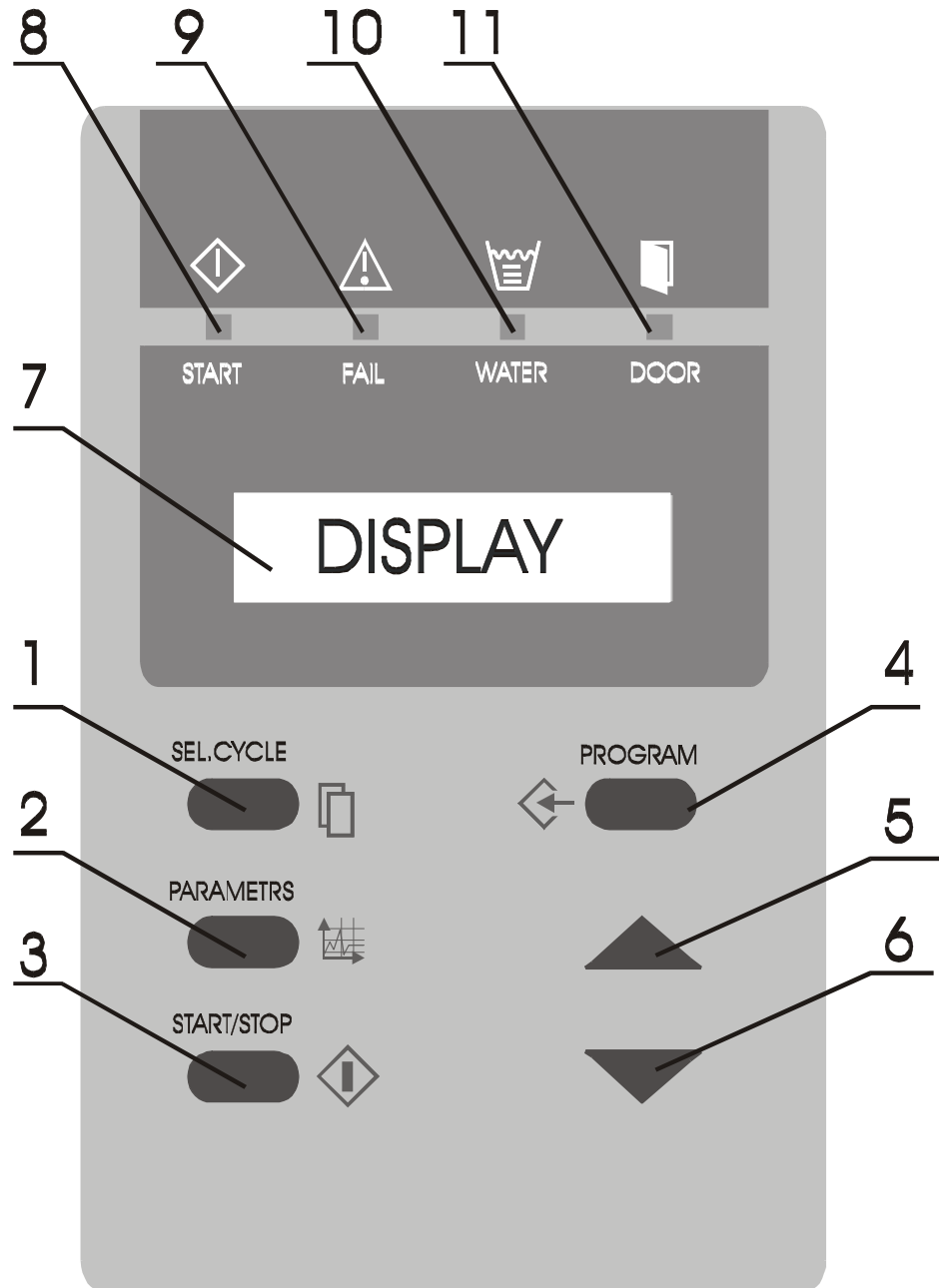
##### Operations Sequence

- ◆ Heating phase; the water enters the chamber and heats up until the sterilization temperature is reached.
- ◆ Sterilization phase; temperature is maintained constant at the preset level for the sterilization time.
- ◆ Forced cooling, to minimize the pressure difference between the bottle with the liquid and chamber. This is done by supplying compressed air into the chamber. The temperature decreases to 85°C and the pressure decreases until it is close to atmospheric pressure. The forced cooling shortens the cooling stage significantly.
- ◆ Slow exhaust phase (Ex. Mode=6); until the pressure equals the atmospheric pressure.



5 **KEYBOARD (keys and display)**

*Front Panel Keyboard*



## 5.1 *Description and Functions of the Front Panel Keyboard*

The command panel is comprised of 3 sections:

On the lower section there are 6 keys; 3 command keys and 3 programming keys.

The middle section consists of the LCD display with two rows and 16 characters on each line.

The top section consists of 4 signal lights that indicate the status of the autoclave.

### 1. Sel. Cycle (select cycle) key



This key enables selecting the desired program out of 6 programs. Pressing this key advances the selected program to the next (e.g. from program 2 to 3).

If the system is set to program 6, pressing the key returns to program 1.

This autoclave has the following available programs:

1. Unwrapped Instruments with fast exhaust without drying 134 °C (273 °F)/ 3 minutes.
2. Unwrapped Instruments with fast exhaust without drying 121 °C (250 °F) /15minutes.
3. Waste 121 °C (250 °F)/20 minutes without drying.
4. Liquids 121 °C (250 °F)/20 minutes without drying.
5. Liquids 105 °C (221 °C)/18minutes with slow exhaust.
6. Special material 121°C (250°C)/30 minutes with cooling and slow exhaust (on model ELVC only)

### 2. Parameters key

This key displays for 3 seconds the three parameters of the program. After selecting the program, it is possible to have the parameters displayed by pressing this key; the top line reads the following data:

<b>Sterilization Temp</b>	<b>Sterilization Time</b>	<b>Dry Time</b>
<b>134 °C</b>	<b>S = 3m.</b>	<b>D=Ø</b>

The data is erased automatically after 3 seconds, or if the parameter key is pressed again during these three seconds.

### 3. Start/ Stop key



This key commands the following 3 functions:

- ◆ Starting the process.
- ◆ Stopping the process.
- ◆ Canceling the FAIL message from the command panel and opening the electric door locking if available.

**Note:**

This key cannot be used during the EXE stage/

**Starting the process:**

It is active while the autoclave is in standby position, if the door is closed and water level in the reservoir is normal, pressing this key starts the selected process.

**Stopping the process:**

It is active while the autoclave is in process, pressing this key at any stage of the process stops operation.

**Canceling the FAIL message**

The end of an aborted process, the FAIL light is turned on and an error message is displayed on the screen indicating the cause of the failure.

Pressing this key cancels the displayed message and switches off the FAIL light.

### 4. Program key









This key is designed for programming the clock and setting different parameters by the service technician by means of the UP (5) DOWN (6) keys.

When the PROGRAM key is pressed, the date is displayed with the cursor under the day. Pressing the PROGRAM key again moves the cursor under the month and then on to the year.

After pressing the PROGRAM key again the time of the day will be displayed with the cursor under the hour. Pressing the PROGRAM key again moves the cursor to the minutes parameter. Each time the UP/DN key is pressed, the value of the parameter above the cursor is changed.

After the date and time parameters are set, pressing the PROGRAM key shows CODE: 000.

A code known to the technical personnel will be set to change certain parameters and perform a digital calibration of the system, as described in detail in the technician section.

- 5. UP key** 
- This key enables increasing the value displayed above the cursor, at the clock programming and for setting of certain parameters by the technician.
- 6. DN key** 
- This key enables decreasing the value displayed above the cursor, at the clock programming and for setting of certain parameters by the technician.
- 7. START LED indicator** 
- When the “START” LED indicator is on it; indicates that the system is running a program.
- 8. FAIL LED indicator** 
- When the “FAIL” LED indicator is on; it indicates that the cycle has failed either as a result of exceeding the allowable limits or the STOP key has been pressed.
- 9. WATER LED indicator** 
- When the “WATER” LED indicator is on; it indicates that there is no water in the chamber.
- 10. DOOR LED indicator** 
- If the “Start” key is pressed and the door is unlocked the light will signal twice and the buzzer will sound four times.
- If a cycle is in progress and fails on door unlocked “FAIL” LED indicator will lit and a message “Door Unlock” will be displayed.

## 5.2 *Description of the Operational Messages*

The display is comprised of 2 rows, each row has 16 characters.

### 5.2.1 *The upper row:*

On the right side of the upper row, 6 characters are allotted for displaying the stage in progress

- ◆ ST. BY - not in operation.
- ◆ WATER - water inlet stage.
- ◆ HEAT - heating stage.
- ◆ STER - sterilization stage.
- ◆ EXH - exhaust stage
- ◆ COOL – forced cooling (if applicable)

On the left side of the upper row, 10 characters are allotted for the selected programs.

- ◆ 1-Instruments (FAST 134) - fast exhaust
- ◆ 2- Instruments (FAST 121) - fast exhaust
- ◆ 3-Waste (Waste 121) - slow exhaust
- ◆ 4-Liquids (liquids 121) - slow exhaust.
- ◆ 5-Liquids (liquids 105) - slow exhaust.
- ◆ 6-Liquid+Cool (Slow 121) - slow exhaust (ELVC only).

When the PARAMETERS key is pressed; the parameters of the selected program are displayed on the upper row.

### 5.2.2 *The lower row:*

On the right side of the lower row, 5 characters are allotted for chamber pressure display.

The actual pressure is continuously displayed at all stages of the process and between processes (standby).

- ◆ On the left side, of the lower row the temperature is displayed; 5 characters are allotted for the display of temperature in °C or °F, in the form 134°C or 273°F.
- ◆ In case the process is aborted, the diagnosis of the fail is displayed on the left of the lower row, instead of the temperature. 11 characters are allotted for this error message.
- ◆ On completion of the process, the END message is displayed in the interval between the readouts of temperature and pressure.
- ◆ At the sterilization stage, the countdown of the time left to the completion of the stage will be displayed in the interval between the readouts of temperature and pressure. The format of the display will be MM: SS (two digits for minutes and two digits for seconds).
- ◆ The time between 2 complete cycles must be at least 10 minutes, in order to give the machine time to cool. If the machine is started within 10 minutes after completion of the

previous cycle, a countdown of time left until the 10 minutes elapse will be displayed in the interval between the readouts of temperature and pressure.

- ◆ When a cycle is started by means of pressing the START key, the load number is displayed for 2 seconds on the left of the lower row.

### Examples

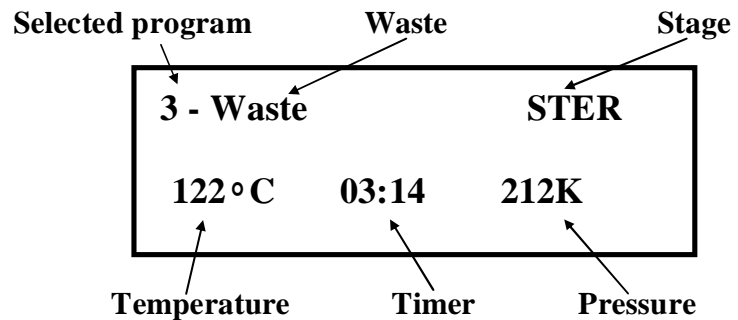
#### Example 1:

Autoclave between processes, the program No.1 has been selected.

<b>1 - Instruments</b>	<b>ST.BY</b>
<b>35°C</b>	<b>100K</b>

#### Example 2:

The autoclave in the sterilization stage, program No.3 is running. The time left to completion of 3 minutes and 14 seconds.



#### Example 3:

The process failed due to temperature drop in the sterilization stage in program No.2.

<b>2 - Instruments</b>	<b>EXH.</b>
<b>LOW TEMP.</b>	<b>178K</b>



### 5.3 *Displayed Error Messages and Safety Measures*

**Low Temp.** Message is displayed, FAIL indicator lights and cycle is aborted, if the temperature drops for more than 5 seconds below the sterilization temperature.

**Low Heat** Message is displayed and sterilization does not start if the autoclave has not reached sterilization temperature after heating for 30 minutes (except in slow exhaust program), and 60 minutes for the slow exhaust program.

**High Temp.** Message is displayed, FAIL indicator lights and the cycle is aborted in one of the following cases:

- ◆ If the temperature rises 3°C (6°F) above the sterilization temperature during the sterilization stage.
- ◆ If the temperature sensor is damaged, this message appears during the HEAT stage.

**Low Pres.** Message is displayed, FAIL indicator lights, and the cycle is aborted if the pressure drops for more than 5 seconds below the pressure correlated to the sterilization temperature.

**High Pres.** This message is displayed, FAIL indicator lights, and the cycle is aborted if pressure rises above the pressure correlated to the sterilization temperature +3°C (6°F) for more than 5 seconds.

**Man. Stop** Message is displayed and the FAIL indicator lights after the STOP key is pressed for longer than 1 second.

**Power Dn** Message is displayed if a power failure occurred during the STERILIZATION stage. When power resumes, the system automatically returns to the point of power failure. This message is displayed for several seconds and the printer prints POWER DN. If the temperature does not fall below the sterilization temperature, sterilization resumes automatically. When power returns, and if temperature falls below the sterilization temperature, the cycle will stop and exhaust will be performed according to the program requirements the system returns to the heat stage and the POWER DN message is displayed and printed.

If a power failure occurred during Program 6 (slow 121), the system does not allow fast exhaust (as exhaust valve is normally closed) during a power failure or when power is back on.

If a power failure occurs during the HEAT stage, heating resumes (provided there is enough water in the chamber). If not, the cycle aborts. Exhaust stages automatically resume operation once the power is back on.

**Door Unlock** Message is displayed and the DOOR LED indicator flashes if the door is improperly closed. The START button should be pressed to start the desired cycle. If the door accidentally opens during any stage of the cycle, the same message and indicator appears, and the system reacts as if the START/STOP key was pressed.

- Low Water** Message is displayed, FAIL indicator lights and the program s aborted.
- ◆ If the electrode sensor indicates no water and the safety thermostat cuts-off during the heating stage.
  - ◆ If the thermostat cuts off, and the micro-controller presumes the electrode sensor is damaged.
  - ◆ If a power failure occurred during the HEAT or STE. stage, the cycle will resume when power returns, provided there is enough water in the chamber. If not the cycle will abort, the message LOW WATER displayed, and the red FAIL indicator lights up.
- Electrode** Message is displayed if the water level electrode is dirty. In this case the message “clean electrode will be printed at the end of the cycle on the printer’s output.
- No Liquids!** Message is displayed, on the bottom row, after pressing the START/ STOP key to start cycles 1 or 2 (Instruments). This message is intended to remind the operator not to sterilize liquids with these two programs. The message disappears after pressing again the START/ STOP key.

## **6 PRINTER**

### **6.1 Printer Operation**

The autoclave is equipped with a character printer, which prints a detailed history of each cycle performed by the instrument (for the record or for subsequent consideration).

The printing is made on thermal paper with 24 characters per line and contains the following information:

- ◆ Software version
- ◆ Real time
- ◆ Selected program
- ◆ Sterilization pressure
- ◆ Sterilization temperature
- ◆ Sterilization time
- ◆ Summary of performed cycle and identification hints.

When the sterilization cycle begins the printer starts printing the above data.

After the preliminary printing, the autoclave starts performing the sequence of operations of the cycle. The measured values of temperature and pressure are printed at fixed time intervals, according to the phase of the process, as shown in the table below.

The data is printed from the bottom up, beginning with the date and ending with "O.K." for a complete cycle or "FAIL" for an aborted cycle.

For an example of a typical printout, see next page.

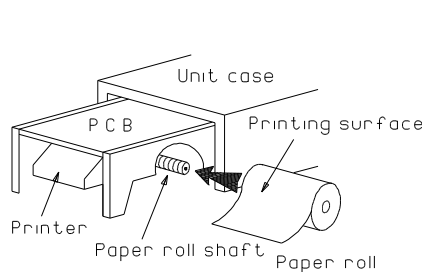
PRINTER OUTPUT	DESCRIPTION
Autoclave:1	Number of autoclave.
Operator : _____	To be filled in manually by operator.
05/01/2010 10:14:20	Date and time sterilization cycle ended.
Load number: 0002	Load number. Useful to determine when to clean the chamber.
Cycle ended	
-----	
E30:35 118.1°C 105.0k	The time, temperature and pressure during exhaust.
-----	
S28:23 135.0°C 309.6k	The time, temperature and pressure during sterilization.
*	
*	Prints sterilization data every 1 minute.
*	
S19:23 134.9°C 310.6k	The time, temperature and pressure during sterilization.
S18:23 134.2°C 307.8k	The time, temperature and pressure during sterilization.
-----	
H16:08 125.2°C 243.8k	The time, temperature and pressure during heating.
-----	
H01:08 020.5°C 097.8k	The time, temperature and pressure during heating.
-----	
W00:00 020.6°C 098.0k	The time, temperature and pressure during water inlet.
-----	
01/01/2000 05:14:56	Date and time sterilization cycle begun.
Dry time: 000min	Drying time for selected program (not applicable in these models).
Ster time: 010min	Sterilization time for selected program.
Ster Temp: 134°C	Sterilization temperature in chamber for selected program.
Cyc: 1-Instruments	Selected program: 1 Unwrapped Instruments 134 cycle
Ver = Lab00Vn1	Number and version of the program

Legend

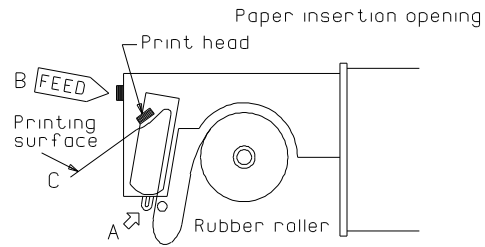
<b>W</b>	<b>Water inlet stage</b>	<b>E</b>	<b>Exhaust stage</b>
<b>H</b>	<b>Heating stage</b>	<b>C</b>	<b>Only on program 6</b>
<b>S</b>	<b>Sterilization stage</b>	<b>k</b>	<b>kPa</b>

## 6.2 DPU-20 Printer Handling

If the autoclave is equipped with a DPU-20 printer refer to this paragraph. The printer is driven and controlled automatically by the control unit, while the autoclave performs a sterilization program.



**Figure 1**



**Figure 2**

To set the paper roll in the printer perform the following steps:

- 6.2.1 Gently push the clips for removing the front panel, remove the panel and pull out the printer gently.
- 6.2.2 Set the paper roll on the shaft (See Figure 1). Since the outer and inner surfaces of the paper are different set the roll so that the printing surface is the outer.
- 6.2.3 Gently push the paper face down into insertion opening (A) in Figure 2. Keep pressing the feed switch (B) until the paper comes out from the print head (C).
- 6.2.4 When the paper emerges from the print head, insert it in the paper cutter (the slot in the front panel) and reassemble the front panel on the unit.

The paper roll is set inside the unit and the printer is ready for use..

**NOTE: If the paper is not pulled in by the rollers even when you press the feed switch (B) push the paper in.**

- 6.2.5 To ensure a reliable operation of the printer perform the following:
  - 6.2.5.1 Turn the main switch to the OFF position.
  - 6.2.5.2 Turn the main switch to the ON position; press the feed switch at the same time. Verify that the printer performs an operation test by printing all the built-in characters

**The following precautions have to be taken ensuring the proper operation of the printer:**

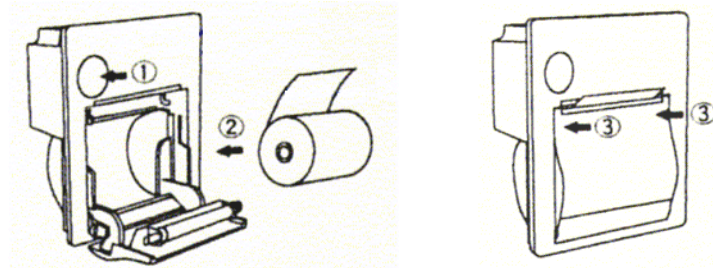
- ◆ Avoid contact between the paper and the hot parts of the autoclave, as the paper will be blackened.
- ◆ Do not pull out the paper roll from the paper insertion opening.
- ◆ Use only the 58mm. wide thermal paper rolls, supplied by your dealer.

### 6.3 *DPU 30 Printer Handling*

#### 6.3.1 *Setting Paper*

If the autoclave is equipped with A DPU 30 printer, follow the instructions in this paragraph.

1. Press the paper cover open button, and open the paper cover. **Handle the paper cutter carefully not to cut your hand.**
2. Set a paper roll as shown in the figure.
3. Close the paper cover by pressing both ends of the cover with the tip end of the paper emerging from the cutter.



#### 6.3.2 *Maintenance*

1. Wipe off the soiling on the printer surface with a dry soft cloth with a weak neutral detergent. After that, wipe the printer with a dry cloth.
3. **Caution:** Never disassemble the printer. Failure to follow this instruction may cause overheating or burning of the printer or the AC adapter. Or an electric shock, which may lead to fires or accidents.
4. Never use the printer in a place of extreme humidity or any place where it can possibly be splashed by any liquids. If any liquids get into the printer, it could lead to fire, electric shock, or other serious accidents.
5. Never touch the thermal head immediately after printing because it becomes very hot. Make sure that the thermal head is cool before setting papers or cleaning the thermal head.
6. Power OFF the printer in any of the following cases:
  - The printer does not recover from an error.
  - Smoke, strange noise or smells erupt from the printer.
  - A piece of metal or any liquid touches the internal parts or slot of the printer.
7. Notes on treatment of thermal papers:
  - Store the papers in a dry, cool and dark place.
  - Do not rub the papers with hard substance.
  - Keep the papers away from organic solvent.

## **7 PREPARATION BEFORE STERILIZATION**

The purpose of packaging and wrapping of items for sterilization is to provide an effective barrier against sources of potential contamination in order to maintain sterility and to permit aseptic removal of the contents of the pack. Packaging and wrapping materials should permit the removal of air from the pack, penetration of the sterilizing water vapor into the pack and removal of the sterilizing vapor.

The basic principle determining the size, mass and contents of instrument and hollowware packs is that the contents are sterile and dry immediately on completion of the sterilization cycle and removal of the pack from the sterilizer chamber.

Instruments to be sterilized must be clean, free from any residual matter, such as debris, blood, pads or any other material. Such substances may cause damage to the contents being sterilized and to the sterilizer.

1. Immediately after use, clean instruments thoroughly to dispose of any residue.
2. Follow the instrument manufacturer instructions.
3. It is recommended to wash instruments with an ultrasonic cleaner, using detergent and mineral-free water.
4. Launder textile wraps prior to reuse.
5. After cleaning, rinse instruments for 30 seconds. (Follow manufacturer's instructions on the use of products for cleaning and lubricating instruments after using the ultrasonic cleaner).
6. Materials, including materials used for inner wraps, shall be compatible with the item being packed and the sterilizing method selected.
7. Use single-use wraps once only and discard after use.
8. If the unit is equipped with a printer, verify if a new roll of paper is necessary.

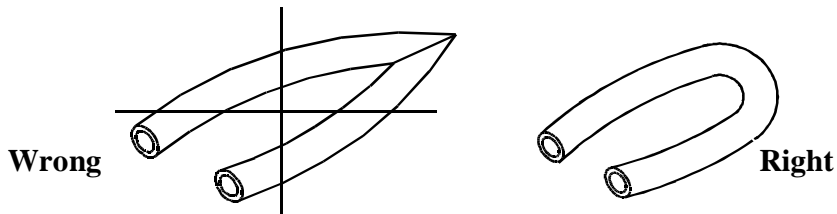
### **7.1 Instruments**

1. Before placing an instrument onto the sterilizer baskets, ensure that instruments that are not constructed of the same metal (stainless steel, carbon steel, etc.) are separated and placed in a different place.
2. Place empty containers upside down to prevent accumulation of water.
3. In case carbon steel instruments are placed in stainless steel baskets, the baskets should be lined with a towel or paper wrap before placing the instruments on the baskets. There should be no direct contact between the carbon steel and the stainless steel baskets.
4. All instruments must be sterilized in an open position.
5. Place a sterilization indicator strip in each basket.
6. Place instruments with ratchets opened and unlocked or clipped on the first ratchet position.
7. Disassemble or sufficiently loosen multiple-part instruments prior to packaging to permit the sterilizing agent to come into contact with all parts of the instrument.
8. Tilt on edge items prone to entrap air and moisture, e.g. hollowware, so that only minimal resistance to removal of air, the passage of steam and condensate will be met.

9. Once a week, use a biological spore test indicator in any load to make sure sterilization is performed.
10. Make sure that all instruments remain apart during the sterilization cycle.
11. Load the basket loosely to capacity.

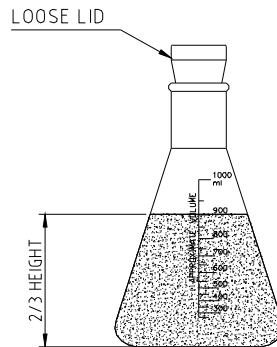
### 7.2 *Tubing*

Clean tubing and rinse with pyrogen - free water. Ensure both ends of the tube are open, and free of any sharp bends, twists or kinks.



### 7.3 *Liquids*

1. Use only heat- proof glass containers, filled to 2/3 capacity.



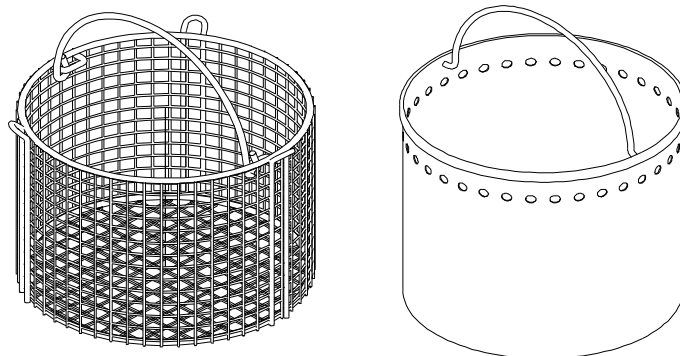
2. For Slow exhaust cooling (without air) the glass container should be covered but unsealed.

### 7.4 *Loading*

The loading of goods and instruments is done by means of two stacked baskets. The baskets are provided with handles for the convenience of the operator.

There are 2 types of baskets:

1. Baskets that are fully perforated.
2. Baskets that are not perforated except one row of holes adjacent to the basket's top. These baskets are intended for waste cycles, to avoid clogging of the vessel's drainage pipe by overflowing liquids.





## 8 OPERATION

### 8.1 Operating Instructions

1. Verify that the mineral free water supply is connected to the mineral free water inlet.

**NOTE: The electrical conductivity of the water must not exceed 15 micro-siemens.**

2. Load the chamber or the basket (optional accessory) with the materials that to be sterilized.
3. If liquids are being sterilized, insert the temperature probe into one of the bottles with liquid. If other materials are being sterilized, let the probe hang freely in the chamber.
4. Close the door, proceeding as follows:

Models 2540, 3150, 3170, 3850 and 3870 are equipped with a side closing mechanism. To close the door, lift the handle of the tightening bolt in vertical position, then rotate it clockwise, until the bolt is hand tight.

Models 5050 and 5075 are equipped with a central closing system. To close the door, turn the handle clockwise, until radial arms are locked.

The “**DOOR CLOSED**“ light is turned OFF, indicating the door is closed and autoclave is ready for operation. Once the sterilization cycle is in progress, a safety device locks the door and makes it impossible to open it until completion of the cycle.

**NOTE: (Except for models 5050, 5075)**

**Due to the inherent elasticity of the door gasket, the CLOSE DOOR indicator light may be turned off before a complete seal is made between the door and the chamber.**

**In order to ensure the door is fully sealed, when the Door light has been turned off continue to tighten the door bolt until “hand-tight”. Do not over-tighten the bolt as this may result in damage to the gasket.**

**Should the autoclave fail to reach sterilizing temperature/pressure, always check first that the door is fully sealed. If not, tighten the door bolt further, as described above, until a complete seal is made.**

5. Turn on the main power switch located at the bottom of the front right corner of the panel, to power the electric system of the autoclave.
6. Set the clock if necessary for the correct date and time, by means of the keys **PROGRAM**, **UP** and **DOWN**, as indicated in Chapter 4.1, ‘Description and Functions of the Keyboard’.
7. Select the required program by means of the key **SEL. CYCLE**. Pressing the **PARAMETERS** key, the main parameters of the selected program, **STER. TEMPERATURE** and **STER. TIME** will be displayed for 3 seconds.

8. Press the **START/ STOP** key to begin operation. If program 1 or 2 were selected a warning message "No Liquids!" will be displayed on the bottom row. After verifying that the load is not liquids, press again the **START/ STOP** key to start the cycle. The **START** signal light is lit; indicating the machine is running a cycle.
9. At the end of the cycle the **START** light is turned off, the **END** message is displayed. In case the cycle has failed, the **FAIL** light is lit, six beeps will be output, the diagnosis of the failure is displayed and the buzzer sounds one beep.
10. Open the door to remove the sterilized material from the autoclave. For models 2540, 3150, 3170, 3850 and 3870 rotate the handle of the tightening bolt counter-clockwise to the end then lower the bolt at right angle, parallel to the front cover. Lift the door in vertical position, ensuring it is stable, before leaving it in this position. For models 5050, 5075 press the UP key to cancel the door locking, at the end of the operation. Rotate the handle counter-clockwise to pull out the locking arms from the retaining brackets. Lift the door in vertical position, ensure it is stable, before leaving it in this position.

## 8.2 *Moving the Autoclave*

1. Disconnect the power supply cord.
2. Disconnect the water and drain hoses.
3. Disconnect the compressed air hoses.
4. Drain the water from the chamber.

**To avoid injuries, lifting and carrying of model 2540 should be done by two people. Moving models 3150, 3170, 3850, 3870, 5050, 5075 should be done by using a forklift.**



### **Caution:**

**Before moving the autoclave, verify that the electrical, air and water connections have been disconnected, and there is no pressure in the chamber.**

**Do not drop this device!**

## 8.3 *Loading and Unloading the Device*

### 8.3.1 *Safety*

Protective equipment and clothes and other safety instructions should be implemented in accordance with local and national regulations and/or rules!

For proper sterilization - Do not overload the chamber. Only autoclavable products shall be used; please refer to the manufacturer instructions for sterilization of unknown materials or instruments.

### 8.3.2 *Loading*

Correct loading of the autoclave is essential to successful sterilizing for several reasons. Efficient air removal from the chamber and the load will permit effective steam penetration and saturation, and allow proper drainage of condensate. Additionally, correct loading will prevent damage to packs and their contents and maximize efficient use of the sterilizer.

For detailed loading instructions, see para. 6 (Preparation before sterilization)

### 8.3.3 *Unloading*

On completion of the cycle, take out the load immediately from the sterilizer. Do not remove the load from the basket until its temperature reduces to the room temperature. Let the load cool down in an area without air movement (air conditioning, etc.) and with minimum people passing by to avoid possibility of touching the hot load. Do not touch the hot load since hot load absorbs moisture and, therefore, may absorb bacteria from your hand. Do not transfer hot load to metal shelves for cooling. Perform a visual inspection to ascertain that sterilizing indicators have made the required colour change, and that the load is dry.

The load shall be rejected if:

- a. The package has been compressed.
- b. The package is torn.
- c. The load is suspected to be wet.
- d. The load fell on the floor.
- e. Condensed drops can be detected on the load.



**To avoid injuries use heat resistant gloves while unloading the autoclave.**

## 9 **DOOR SAFETY SYSTEM**

The door opening is ensured by two means:

1. The closing device prevents an incidental opening of the door.
2. A pull-type solenoid that in inactivated position locks the door and must be electrically powered to release the locking and enable the opening of the door.

### 9.1 **Solenoid locking device**

The solenoid locks the door in the following situations:

1. When the control unit is not powered.
2. If power failed or has been turned off while the autoclave is in operation, even if power has been restored.
3. If operation was stopped before completion of the cycle as a result of a failure or a manual stop.
4. When the temperature inside the autoclave chamber is higher than the “end of cycle” temperature, preset by the operator; the opening of the door is possible only when the temperature has dropped below preset value.

For cases described at points 2 and 3, press START/STOP key to cancel the door locking at the end of the operation.

If, for any reason, the locking mechanism does not open, call for Tuttnauer service.



**Warning!**  
**Do not use force to open the door.**

### 9.2 **Door Safety System for models 5050, 5075**

#### 9.2.1 **Door Components**

- A circular frame with a “C” cross section is welded on the topside of the vessel. When the door is closed it lays on the “bottom leg” of the frame.
- The door plate mechanism consist the following:
  - a. A centric shaft welded to the doorplate (2).
  - b. An arm housing (3) that holds the 8 arms and is able to swivel on a thrust bearing. The housing is secured.
  - c. Bakelite handle (4), which is operated by the operator, is installed directly on the housing.
  - d. 8 arms (5), which are held in the arm housing in such a way that they, are rotatable. These arms are freely located in a guide (6), which enable them to move in an angular movement due to the rotation of the arm holder.

**Note:** the drawing provided below describes the door in the “locked” position: The handle is positioned in 10:00-4:00 (hour) angle, and the arms are pushed radially into the circular frame.

The “open” position is when the handle is located in 7:00-1:00 (hour) angle. In this position the arms are

retracted from the circular frame due to the rotary movement of the arm holder to a position which is described in dotted lines.

## **9.2.2 Safety means**

The door is equipped with three safety means as follows:

### **9.2.2.1 Locking solenoid (7)**

This solenoid is a “Normally pushed” pin type and is located on an adjustable base (8). The solenoid’s pin is spring loaded in such a way that when it is not activated, the pin is pushed out.

A bracket with a hole is attached on the arm holder. The hole is located in such a way that the solenoid pin, when pushed, will be trapped in the hole.

An inclined tongue is welded to the bracket. This tongue assists the pin to retract when the locking mechanism is turned to the “unlocked position”. When the pin is in the “locking position” it prevents the arm holder from any angular movement.

### **9.2.2.2 Safety locking microswitch (10)**

This microswitch is activated when the arms are in a radial – “locked” position.

The microswitch signal one of the following:

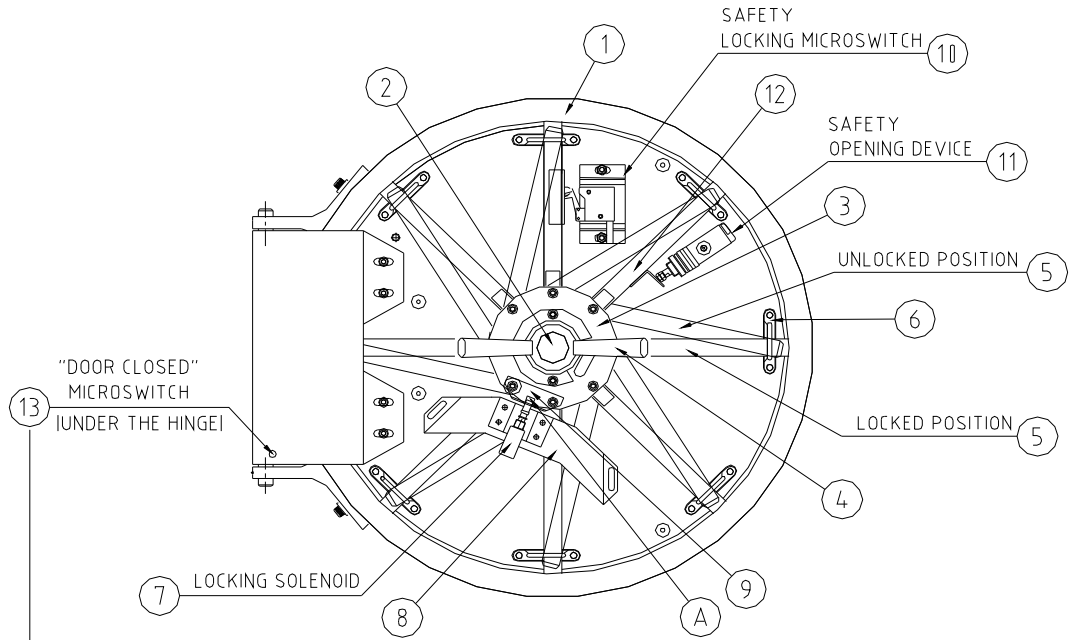
- a. Arms are locked – cycle can be activated
- b. Arms are in a non-locked position. It is possible to start a cycle and the door can be opened.

### **9.2.2.3 DOOR CLOSED microswitch (13)**

This microswitch is located under the circular frame (1) and has an activating rod piercing through the frame. When the door is closed it presses the micro-switch’s rod. At this stage the microswitch sends a signal that the door is closed.

The two micro-switches (10 and 13) ensure that operation cannot be started if autoclave door is unlocked. When the two micro-switches are activated, the light “Door Closed” on the keyboard panel is ON and operation can be initiated.

SAFETY DOOR DEVICE  
MODELS: 5050, 5075



#### **9.2.2.4 Safety opening device (11)**

This Safety device is a 3/2 operating pneumatic spring loaded valve (2 position, 3 ports) that is connected to the safety port of the door. An angular bracket (12), which is attached to one of the arms, will push the valve's piston to a position that at the instant that the arms are locked, the safety port of the door is blocked.

At the instant that the arms moves backward the valve changes its position and the chamber is vented. After the pressure in the chamber equalizes the ambient pressure the autoclave's door can be opened with no risk for the operator, of steam or hot water burst.

### **9.2.3 Safety Process Description**

9.2.3.1 The user closes the door and rotates the handle clockwise approx. 90°

- a. At the end of the circular movement of the arms holder, the pin of the locking solenoid slides to its locking position.
- b. When the arms moves the last radial 15 mm, one arm activate the microswitch, while another arm (on which there is the angular bracket) pushes the piston of the 3/2 valve to a position that the venting port of the door is blocked.

9.2.3.2 The user start a sterilization cycle by pressing a “start” key on the operating panel.

9.2.3.3 Cycle completion.

There are 6 sterilization programs:

- a. Program 1 and 2 will end if the cycle is completed and the pressure in the chamber is below 115 kPa (abs).
- b. Programs 3 to 6 will end if the cycle is completed, the pressure decreases below 115 kPa (abs) and the chamber temperature decreases below 85°C.

9.2.3.4 After all completion conditions are fulfilled, the operator must rotate the handle a little bit counterclockwise to activate the microswitch (10).

Activating the microswitch will cause the “door” light to flash a few times.

When the first step of opening the door is performed and arms are unlocked turning the handle counterclockwise, the arms change direction, the piston is released and valve opens, chamber is aerated and residual pressure discharged from the chamber.

This way, the second step, opening the door by pulling it, can be done safely, with no risk for the operator, of steam or hot water burst.

After the "door light" had signaled the operator will press the "up" key and the solenoid will retract.

At this stage the unlocking operation is completed and the operator can open the door.

### **9.3 *Piston Lifting Device For 3850/3870/5050/5075 ELV***

In order to ensure the stability of the door in the open position and avoid a sudden jolt downwards of the door which can hurt the operator, a hydro-pneumatic safety device, is provided to ensure the smooth lifting and lowering of the door, facilitating the handling of it.

The device is a gas-pressurized spring, which incorporates a cylindrical barrel filled with oil and nitrogen gas. The spring force, that damps the door movement, is produced by the compressed nitrogen filling. A piston-rod is telescopically guided within the cylindrical barrel and fixed by the side of the door to the rear.

There is one cylinder for the models 3850/3870 and two cylinders for the models 5050/5075.



## 10 SERVICE AND MAINTENANCE

### 10.1 Preventive Maintenance

The maintenance operations described in this chapter must be fulfilled periodically in order to keep the autoclave in good working condition and to reduce the breakdown time to a minimum.

The user's maintenance personnel, according to the following instructions can easily execute these operations.

The owner of the autoclave is responsible to order an authorized technician to perform the periodical tests and preventive maintenance operations, as specified in the technician manual.

Use only mineral-free water as detailed in para. 2.10 (water quality).



#### **Warning**

**Before carrying out any preventive maintenance operation, ensure that the electrical cord is disconnected and there is no pressure in the autoclave.**

#### 10.1.1 Daily

Clean the door gasket with a soft cloth. The gasket should be clean and smooth.

#### 10.1.2 Weekly

1. Remove the baskets (if applicable). Clean the chamber and baskets with a cleaning agent & water and with a cloth sponge. You may use diluted lemon acid (25-50 CC lemon acid in 1 liter of water) as cleaning agent. If detergent is used, rinse baskets immediately with water to avoid stains on the metal.



#### **Caution**

**Do not use steel wool or steel brush as this can damage the chamber!**

2. Put a few drops of oil on the two door pins and door tightening bolts.
3. Clean outer parts of the autoclave with a soft cloth.
4. Drain out the vessel and clean the electrode with a soft cloth.

#### 10.1.3 Periodically

1. Every 6 months replace the air filter, (if installed) according to para. 10.2.
2. Every 6 months clean the electronic box with compressed air, from inside outward.
3. Check the door gasket every 12 months and replace it if required (see para. 10.3).
4. Once a year check and tighten the piping joints to avoid leakage.
5. Once a year check and tighten all screw connections in the control box, heaters, valves and instrumentation.
6. Once a month clean the strainer as per para. 10.5. Cleaning frequency may be reduced according to experience.

#### **10.1.4 Periodical Tests**

1. Once every month activate the safety valve (see para. 10.4).

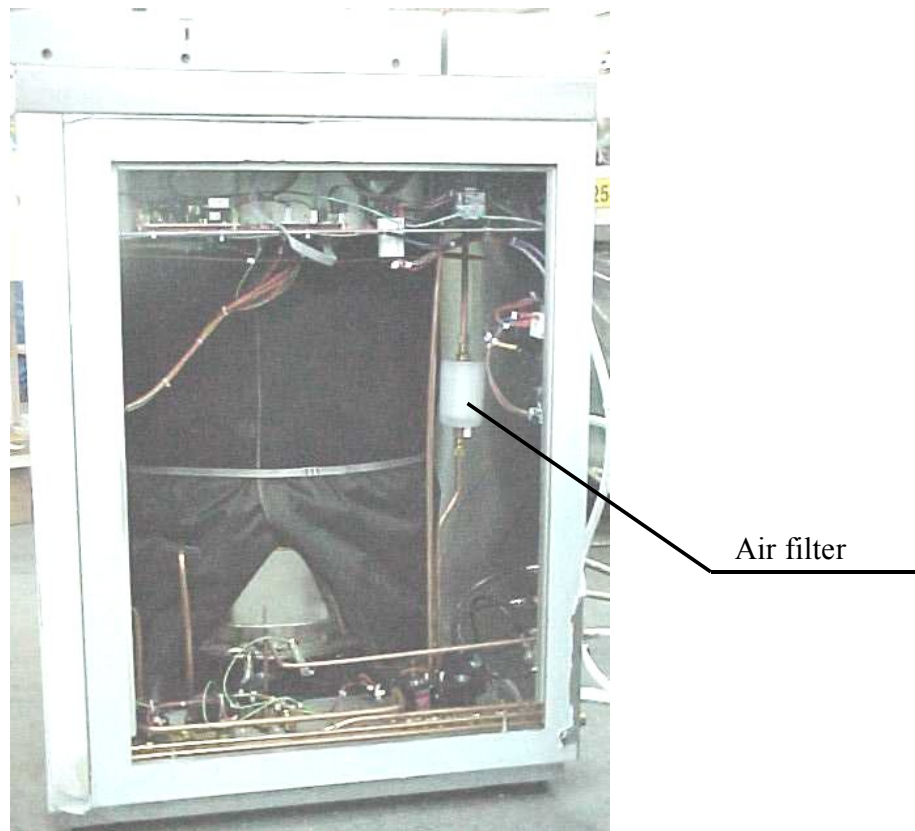
#### **10.2 Replacing the Air Filter**

In order to increase the pressure during the fast cooling stage, compressed filtered air enters the chamber via a solenoid valve. The filtration of the air is performed by the bacteriological filter that is placed at the inlet of the chamber, through a solenoid valve.

The filter is mounted at the right side of the autoclave. .

To replace the filter proceed as follows:

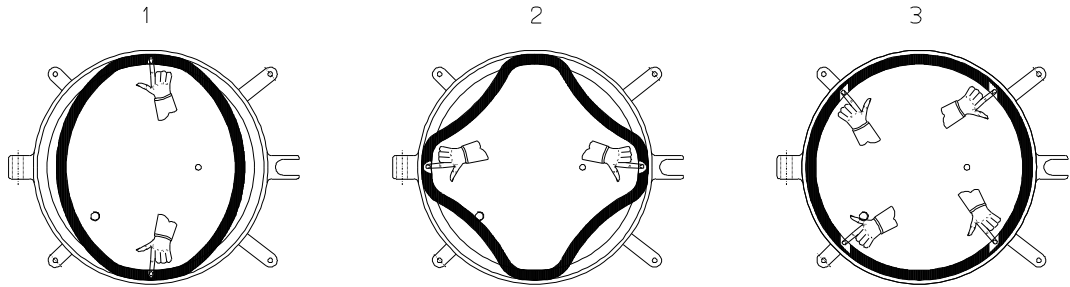
1. Open the right service door of the autoclave.
2. Unscrew the fittings (upper and lower fitting) connecting the filter to the piping.
3. Replace the filter with a new one and reconnect the fittings.
4. Close the service door.



### 10.3 Replacing the Door Gasket

(For models 2540, 3150, 3170, 3850, 3870)

(Gaskets of models 5050, 5075 shall be replaced by a technician. See technician manual)



Pull off the gasket from the door groove and install the new gasket referring to the drawings as above points 1, 2 and 3.



#### **Caution!**

**This gasket is designed with a trapezoidal cross section. The gasket should be placed with the widest side towards the door.**

### 10.4 Checking the Safety Valve

The safety valve is located on the rear side of the autoclave

In order to prevent the safety valve from a blockage, operate it once a month.

#### 10.4.1 PED-approved type safety valve

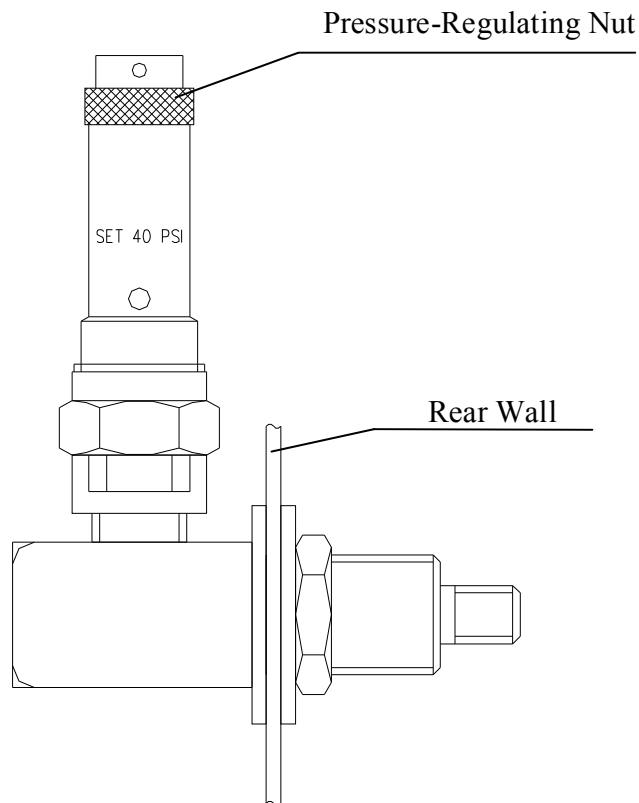
1. Operate the sterilization cycle according to the manual.
2. Allow a pressure of approximately 200 kPa (29 psi) to build up in the chamber.
3. Turn the safety valve pressure-regulating nut counterclockwise for 2 seconds. Be careful not to burn your hands.



**Attention:**

***Use protective gloves in order not to burn your hands with the hot steam.***

4. Return the nut to its original position.
5. Press the STOP key to interrupt the operation, and exhaust steam from chamber.
6. Wait until the pressure decreases to zero, only then can the door be opened.



### 10.4.2 ASME-approved type safety valve

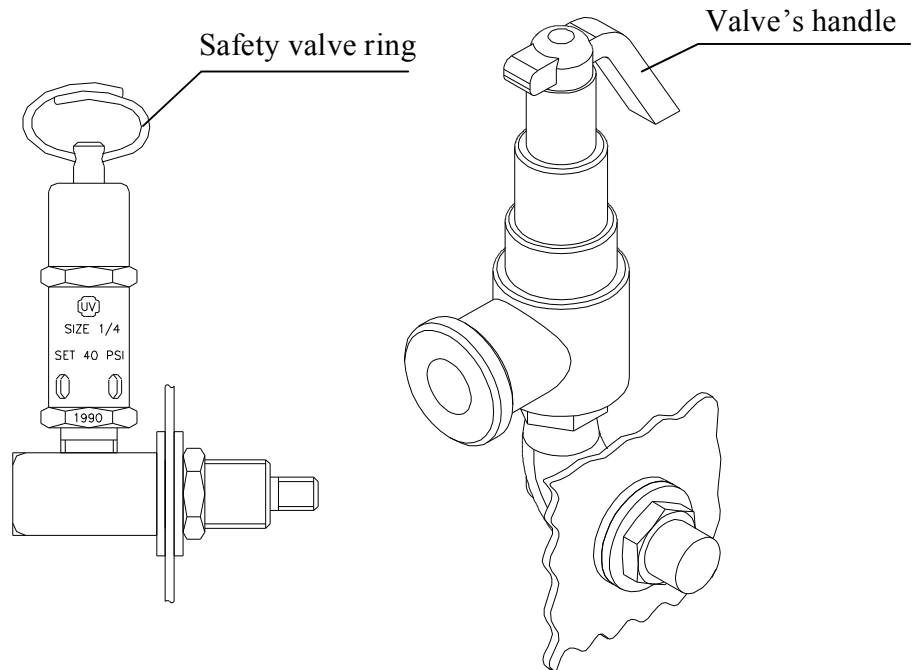
1. Operate the sterilization cycle according to the manual.
2. Allow a pressure of approximately 300 kPa (29-psi) to build up in the chamber.
3. Operate the safety valve:
  - 3.1 On models 2540, 3150, 3170, 3850, 3870 pull the ring of the safety valve using a tool, i.e. screwdriver, hook etc and lift the safety valve ring for 2 seconds. Be careful not to burn your hands.
  - 3.2 On models 5050, 5075 press the valve's handle and verify that steam escapes from the valve.
4. Press the STOP key to pause operation, and exhaust steam from chamber.
5. Wait until pressure goes down to zero, only then can the door be opened.



**Attention:**

***Use protective gloves in order not to burn your hands with the hot steam.***

6. Press the STOP key to interrupt the operation, and exhaust steam from the chamber.
7. Wait until the pressure decreases to zero, only then can the door be opened.



**For models 2540, 3150, 3170, 3850, 3870**

**For models 5050, 5075**

### 10.5 *Cleaning water outlet strainer*



**Caution!**

**Before proceeding, Make sure that the electric cord is disconnected and there is no pressure in the autoclave.**

1. Open the left service door.
2. Open the strainer cover.
3. Remove the strainer element.
4. Rinse the strainer with water, using a brush if necessary.
5. Reinstall the strainer element.
6. Close the strainer cover.
7. Close the left service door.

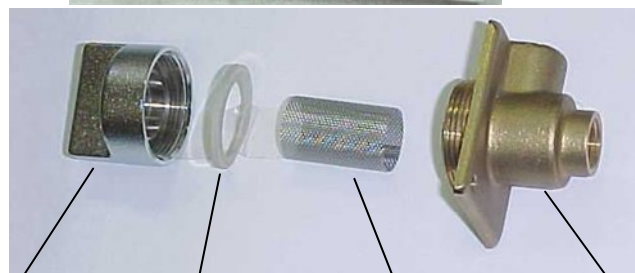


**Attention:**

**Ensure the gasket is not misplaced, as this will prevent using the autoclave.**



Strainer



Cap

Silicon  
gasket

Strainer  
element

Strainer  
housing

## 11 TROUBLESHOOTING

This troubleshooting chart enables the user to solve minor malfunctions, prior to contacting our service department. Only technical personnel having proper qualifications and holding technical documentation (including a technician manual) and adequate information are authorized to service the apparatus.

Problem	Solution
1. The machine is not responding	1.1 Check the power source and verify that it is according to specifications. 1.2 Verify that the main switch is in the 'On' position. (see top view drawing). 1.3 Make sure the power cord is properly connected to the machine and the mains. (see rear view drawing) 1.4 Check the reset button on the cut-out thermostat. Reset if necessary. 1.5 Make sure the circuit breaker has not tripped and reactivate it if necessary.
2. 'Low Heat' is displayed	2.1 Make sure the machine has the proper amount of sterilization load.
3. 'Low Pres' is displayed	3.1 Check the door for leakage and replace the door gasket if necessary. (see para. 10.3 Replacing the Door Gasket) 3.2 Verify that no instrument makes contact with the electrode by protruding through the holes of the basket. Rearrange the instruments in the basket and restart the cycle.
4. 'High Temp' is displayed	4.1 Clean the water level electrode inside the vessel.
5. 'High Pres' is displayed	5.1 Clean the water level electrode inside the vessel.

<b>Problem</b>	<b>Solution</b>
<p>6. You cannot change programs and the FAIL light remains on.</p>	<p>A problem with the printer paper often prevents the operator from changing programs. To rectify the problem, perform the following:</p> <ul style="list-style-type: none"> <li>— Turn off the main switch.</li> <li>— Remove the printer paper as described in the Chapter on “Printer Handling”.</li> <li>— At this point the no paper indicator on the printer lights.</li> <li>— Turn the main switch on. The cycle should return to the previous stage.</li> <li>— At this point insert the printer paper, verifying that it is inserted properly.</li> <li>— If the cycle does not return to its former stage, the technician must perform a memory reset as described in this manual.</li> <li>— After performing a reset, insert the printer paper with care.</li> </ul>
<p>7. The printer prints, but nothing is printed on the paper.</p>	<p>7.1 Make sure the paper is mounted in the right way. Only one side of the paper is printable. (see para. 6.2, Printer handling)</p>
<p>8. The printer does not print.</p> <p>If equipped with a printer</p>	<p>8.1 Make sure the paper is inserted in the printer. (see para. 6.2, Printer handling)</p> <p>8.2 Switch off the machine and switch it back on while pressing the feed button on the printer. If the printer prints a test printout, the printer is O.K. and there is a problem with the electronics. Contact your dealer to solve the problem. If the printer does not print the test printout, there is a problem with the printer. Contact your dealer to solve the problem.</p>
<p>9. When the machine is switched on, the printer feeds paper all the time.</p>	<p>9.1 Make sure the ‘feed button’ on the printer is not stuck.</p>



Problem	Solution
10. Steam leaks at the machine's door	10.1 Make sure the door is tightened enough. Replace the door gasket. (see para. 10.3 Replacing the Door Gasket)
11. When running a cycle, the exhaust stage takes a very long time.	11.1 If you are running a 'liquids' program this is normal. (see, PROGRAM 5)
12. Water does not exit chamber due to clogged outlet strainer.	12.1 Clean strainer according to instructions.

**If the above recommendations did not correct the malfunction, or if any problems not discussed in this section were encountered please contact your dealer or point of purchase for further assistance.**



**Container for waste products**

**High Basket**

**Low Basket**

Type	Stainless steel wire baskets		Stainless steel container for waste products, with vent holes	
	Dia. x Height (mm)	Capacity	Dia. x Height (mm)	Capacity
2540	227 x 350	1	236 x 190	2
	227 x 178	2	236 x 350	1
3150	284 x 225	2	292 x 225	2
	284 x 325	2	292 x 340	1
3170	284 x 225	2	292 x 225	3
	284 x 325	2	292 x 340	2
3850	357 x 220	2	366 x 330	1
	357 x 330	1	366 x 220	2
3870	357 x 330	2	366 x 330	2
	357 x 220	3	366 x 220	3
5050	465 x 235	2	474 x 350	1
	465 x 350	1	474 x 235	2
5075	465 x 350	2	474 x 350	2
	465 x 235	3	474 x 235	3

## 12 SPARE PARTS LIST

Description	Cat.No.			
	2540	3150/3170	3850, 3870	5050, 5075
Cord + plug + socket EUR 230V	WIR040-0003	WIR040-0002	—	—
Cap for ¼” strainer	FIL175-0027	FIL175-0027	FIL175-0027	FIL175-0027
Strainer element	FIL175-0046	FIL175-0046	FIL175-0046	FIL175-0046
Teflon gasket 4 mm	GAS082-0008	GAS082-0008	GAS082-0008	GAS082-0008
Door gasket	GAS080-0003	GAS080-0029	GAS080-0004	—

## 13 ACCESSORIES

Description	Cat. No.				
	2540	3150/3170	3850, 3870	5050, 5075	
Paper, Roll, Printer, DPU-20	THE002-0003	THE002-0003	—	—	
Paper, Roll, Printer, DPU-30	—	—	THE002-0025	THE002-0025	
Stainless steel wire basket	High	BSK254-0001	BSK314-0001	BSK387-0001	BSK507-0001
	Low	BSK254-0004	BSK314-0002	BSK387-0002	BSK507-0003
Stainless steel container for waste products, with vents holes	High	BSK254-0005	BSK314-0003	BSK387-0005	BSK507-0009
	Low	BSK254-0003	BSK314-0004	BSK387-0003	BSK507-0002