



## STRUCTURE, MAINTENANCE MEASURES AND TROUBLESHOOTING OF STEAM STERILIZERS.

*Kochkarova Shoirabrohim qizi*

*Andijan state technical institute, Faculty of Automotive Engineering 4th year  
student of Biomedical Engineering  
[shoirabrohimjanovna@gmail.com](mailto:shoirabrohimjanovna@gmail.com)*

*Ismoiljonov Yodgorbek Komiljon o'g'li,*

*Andijan state technical institute Senior lecturer, Department of Metrology and  
light industry,  
[yodgorbek93@gmail.com](mailto:yodgorbek93@gmail.com)*

**Annotation:** *Steam sterilizers are of great importance in the medical and pharmaceutical industries, and their main task is to clean equipment and materials from microorganisms. This work examines in detail the structure, maintenance measures and troubleshooting methods of steam sterilizers. Structurally, steam sterilizers use steam under pressure to carry out a disinfection process at high temperatures. Their main components are a boiler, a steam extraction system, control and automation devices, as well as sensors for measuring temperature and pressure. Maintenance measures are necessary to ensure the effective operation of sterilizers. These measures include regular cleaning, technical supervision and necessary repairs. Malfunctions can occur for various reasons, such as pressure drops, temperature changes or problems with the mechanical parts of the device. To eliminate these malfunctions, methods such as diagnostics, repairs and replacement of spare parts are used. This study provides important information for*



*improving the efficiency of steam sterilizers and solving problems that arise during their use.*

**Keywords:** *malfunction, sterilization, diagnostics, gravity, Bowie-Dick, lid, whistle, manometer, valve, vacuum.*

There are two types of steam sterilizers, gravity-driven steam sterilizers and high-velocity steam pre-vacuum sterilizers. Gravity-driven steam sterilizers: are used primarily for processing laboratory media, water, pharmaceuticals, regulated medical waste, and items whose non-porous surfaces come into direct contact with the steam. Steam is introduced from the top or sides of the sterilization chamber. It displaces the air in the bottom of the chamber through a drain outlet. Since the air is not completely evacuated, the steam penetration time on porous objects increases. Not intended for high-temperature sensitive devices.

High-velocity steam-driven vacuum sterilizers: air completely penetrates the porous material. The Bowie-Dick test is used. It uses surgical gauze pads to detect air leaks or inadequate air removal from the sterilization chamber.

**Procedure.** Place the Bowie-Dick test strip in the center of the test bag placed in the sterilization chamber and operate the chamber at 134 degrees for 4 minutes. The test is considered passed if the test strip in the test bag shows uniform color changes. The sterilization chamber can be equipped with a vacuum pump to ensure that all air is removed before steam is introduced. The Bowie-Dick type of sheet is specially designed to simulate the materials to be sterilized and to test the effectiveness of the vacuum system in the autoclave that creates the initial vacuum.

**Structure of steam sterilization.** The high-pressure chamber is the main component of the autoclave. It consists of an inner chamber and an outer shell. The inner chamber is a stainless steel or bronze shell, and the outer chamber is a steel shell. Autoclaves used in medical laboratories and hospitals have an outer shell



filled with steam to reduce the time it takes to reach the sterilization temperature. The inner chamber is the housing in which the materials to be sterilized are placed. The volume of the high-pressure chamber can range from 100 to 3,000 liters.

Lid: isolates from the outside atmosphere and maintains the required temperature and pressure inside the autoclave. Consists of three parts: pressure gauge, whistle, and safety valve.

Pressure gauge: indicates the pressure generated in the autoclave during sterilization. Ensures the safe operation of the sterilizer and the operating condition for operation.

Whistle: controls the pressure inside the chamber by releasing a set amount of steam.

Safety valve: has a thin rubber layer, if the steam sterilizer fails to do its job, this layer bursts to reduce the pressure inside the chamber

Steam generator: is located at the bottom of the chamber. It has an electric heating system that heats the water it produces inside the chamber. Users should always check that there is enough water in the generator to ensure the smooth running of the process and to prevent burning or excessive wear of the autoclave parts.

Vacuum generator: removes air from the chamber, as air bubbles in the chamber can create a breeding ground for any organisms and thus prevent the equipment from being sterilized.

Wastewater cooler: cools the waste before it enters the drain pipes. The purpose of the wastewater cooler is to reduce the temperature of the high-temperature hot water before it is discharged into the drain pipes to prevent damage to the pipes.



Control/adjustment system: most sterilizers are equipped with a control interface. The sterilization cycle follows a pre-programmed software program that opens and closes valves and other components in a specific sequence.

Thermostatic valve: Allows air and water to escape from the chamber. It removes condensate without allowing dry steam to escape.

### **Maintenance measures:**

1. Make sure all cables and connectors are properly connected.
2. Check the display and screen for damage or deterioration.
3. Check the hoses inside the steam sterilizer for damage or abrasion.
4. Check the temperature sensor for debris or damage.
5. Check the water level sensor in electrically heated steam sterilizers to prevent the formation of deposits.
6. Check the chamber lid gasket for any damage, such as cracks.
7. Check the inside of the chamber and the chamber lid for damage such as corrosion or cracks.
8. Check the door hinges, hinge shaft stopper rings, lid hinges, or lid hinge latch for corrosion or cracks.

### **Troubleshooting.**

1. If the power switch is turned on but nothing appears on the control panel, the power cable may not be connected or the fuse or relay on the power source side may be burnt or broken. In this case, it is necessary to check whether the power cable is connected and connect the power cable to a power source with the power required by the sterilizer.
2. If the temperature rises too high, the water volume in the chamber is too large or the volume of the items to be sterilized is large, it is necessary to check the



water volume for sterilization and reduce it to the optimal level, and optimize the volume of items to be sterilized.

3. If the sterilization is not completed to a sufficient degree, the sterilization time will not be enough. It is necessary to extend the sterilization time.
4. If there is leakage from the chamber cover, dust, etc. may have adhered to the chamber cover roller or hole, or the chamber cover roller may be damaged or broken. It is necessary to contact the manufacturer to clean the chamber cover roller or hole, unplug the power plug from the outlet, and repair.
5. Steam is leaking from the safety valve, the pressure in the chamber may be high. Unplug the sterilizer from the power outlet and contact the manufacturer for repair.

**Conclusion.** There are two main types of steam sterilizers: gravity-driven steam sterilizers and high-velocity steam pre-vacuum sterilizers. Gravity-driven sterilizers work by displacing air with steam, mainly used for non-porous items, but they have limited steam penetration in porous objects. High-velocity pre-vacuum sterilizers remove air completely before introducing steam, ensuring effective sterilization, especially for porous materials. The Bowie-Dick test is used to check the vacuum system's efficiency. An autoclave's key components include a high-pressure chamber, lid with safety features (pressure gauge, whistle, safety valve), steam generator, vacuum generator, wastewater cooler, control system, and thermostatic valve. Proper maintenance involves regularly checking cables, sensors, gaskets, and components for damage or wear.

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