



HOT AIR OVEN

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Hot Air Oven

- A hot air oven is a type of **dry heat sterilization** that works on the principle of **heat conduction**, in which the articles are sterilized layer by layer, starting from the surface towards the center.
- In this system, dry heat is recirculated within a chamber at a temperature ranging between 50-300 °C to sterilize **thermally stable objects**.
- A hot air oven makes the use of dry heat to **oxidize** the **cellular components** of the microorganisms and their spores to kill them.
- A hot air oven is another way of sterilizing articles like glassware, metals, surgical equipment, powders etc.

Types

Static air-type oven:

In this, the electric coils are located at the bottom, which permits the upward flow of the hot air. The movement of heat is through the **gravity convection** employing electrical coils at the bottom. Its efficiency is low in transferring heat energy.

Forced air-type oven:

In this, the motor-driven blowers permits the uniform distribution of the hot air. The movement of heat is through **forced** or **mechanical convection** like air blowers. It is more efficient in heat conduction, i.e. it transfers the energy from the dry air more rapidly to the instrument.

Principle

- Sterilizing by dry heat is accomplished by conduction. The heat is absorbed by the outside surface of the item, then passes towards the Centre of the item, layer by layer. The entire item will eventually reach the temperature required for sterilization to take place.
- Dry heat does most of the damage by oxidizing molecules. The essential cell constituents are destroyed and the organism dies. The temperature is maintained for almost an hour to kill the most difficult of the resistant spores.
- While operating a dry heat sterilizer, we must consider the two factors like **holding time** of the microorganisms and **optimum temperature** to kill them.

Working principle

Hot Air Oven is an electrical device that works on Heat convection principle. It consists of electrical heating coil that produces dry heat. In the chamber, the produced dry heat air displaces the cooled air forming heat gradient. The use of fan allows to the uniform distribution of heat. The Hot Air Oven is usually set at following temperature and for mentioned time-

170°C (340°F) for 30 minutes

160°C (320°F) for 60 minutes

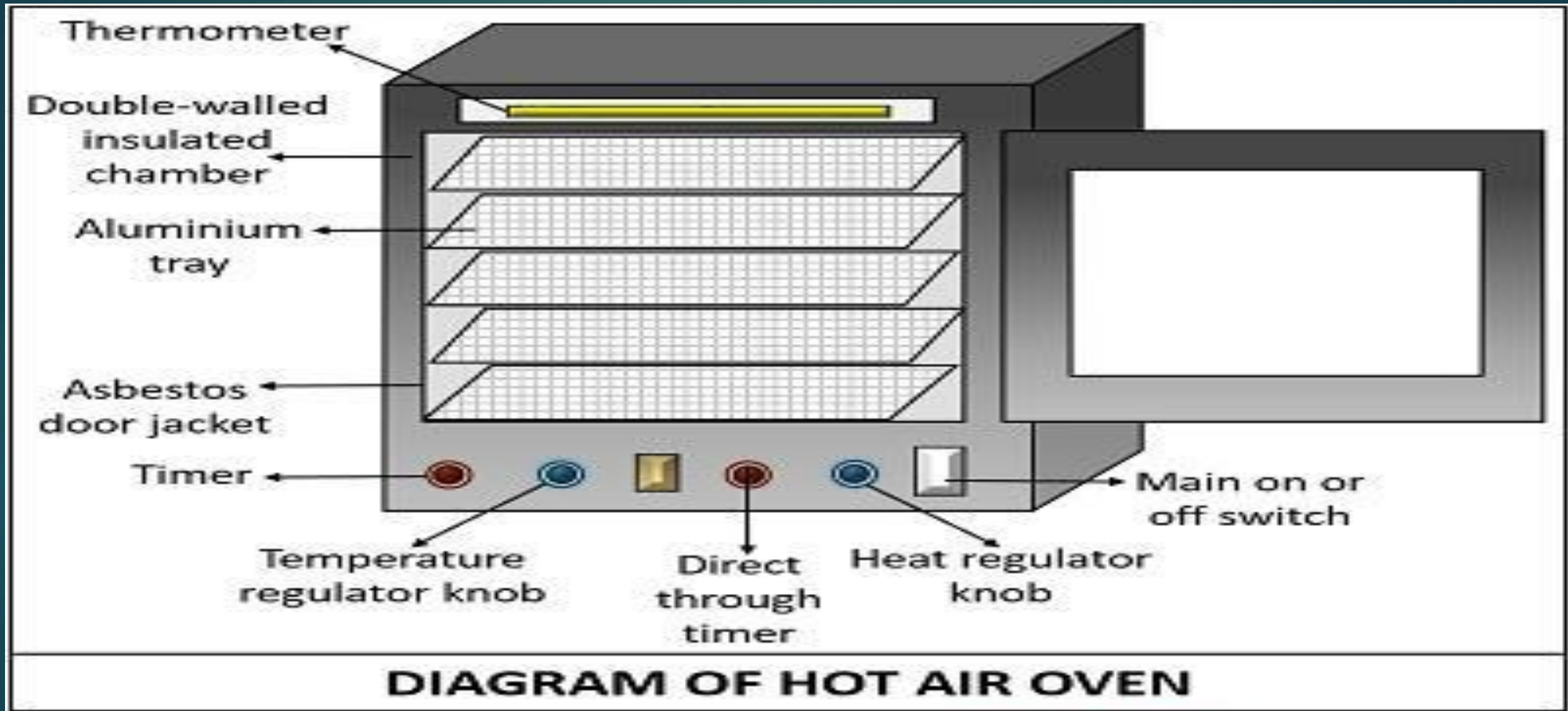
150°C (300°F) for 150 minutes

Structure of Hot air oven

It consists of the following parts:

An insulated chamber surrounded by an outer case containing electric heaters

- ▶ A fan
- ▶ Shelves
- ▶ Thermostat
- ▶ Door locking controls



Technical Specifications

Temperature Range	2°C to 90°C /5°C above ambient to 90°C (Standard)
Temperature Sensor	PT-100
Temperature Controller	Solid State digital Controller/ PID optional
Display	LED/LCD
Adjustable alarm limits Water quality	Optional With PID controller only
Water Quality	Distilled / Ionized
Temperature variation Adjustments	3 (With PID Controllers only)
Water reservoir	18 ltr
Maximum Permitted load per shelf	25Kg
Maximum Permitted total load	75Kg
Nominal Power Consumption	950 W
Nominal Voltage Consumption	220-230 Volts, 50 Hz Single Phase
Frequency	50 Hz

Operations

- ▶ Firstly, plug in the oven and switch it on.
- ▶ Then, preheat the oven for at least 30 minutes before loading the items.
- ▶ After that, set the temperature gauge at the desired time relative to the volume of the contents that you need to sterilize.
- ▶ Load the articles on the middle shelf, or you can also put the remaining items on the other shelf depending upon the volume of articles.
- ▶ Maintain proper space between the equipment on the adjustable aluminium trays for adequate heat circulation.

Applications

- ▶ Biochemical studies
- ▶ Hematological studies
- ▶ Bacterial Culturing and Research
- ▶ Microbiological Determinations
- ▶ Pharmaceutical Stability Assays
- ▶ Food Processing Quality Control
- ▶ Large Scale Roller Apparatus

APPLICATIONS OF HOT AIR OVEN



Used to sterilize the metal equipments



Commonly used in laboratories to perform research-based operation



Used in many industries for the drying, baking and curing processes



Used to sterilize powders and other non-volatile compounds



Used to sterilize the heat-stable glasswares

Advantages

- ▶ Do not require water and there is not much pressure build-up within the oven making it safer to work.
- ▶ Smaller than autoclave but can still be as effective.
- ▶ Higher temperatures can be reached compared to other means.
- ▶ This treatment kills the bacterial endotoxin, not all treatments can do this.
- ▶ An effective method of sterilization of heat-stable articles only method of sterilizing oils and powders.
- ▶ Protective of sharps or instruments with a cutting edge (fewer problems with dulling of cutting edges).
- ▶ It does not leave any chemical residue.
- ▶ It is non-toxic and does not harm the environment.

Disadvantage

- ▶ Some organisms like prion may not be killed or inactivated.
- ▶ Plastic wares or heat-sensitive materials can't be sterilized.
- ▶ Glasses may become smoky due to high sterilization temperatures: The temperature holding period is at 160°C for 1 hour, 170°C for 30 minutes whereas at 180°C for 20 minutes.
- ▶ Dry heat penetrates materials slowly and unevenly and is thus a time-consuming method because of the slow rate of heat penetration and microbial killing.
- ▶ It requires a continuous source of electricity.

Maintenance

- ▶ Clean the device once a week using wipes, paper towels etc.
- ▶ The oven should be operated on proper power, to avoid reduced performance and damage to the equipment.
- ▶ Place the hot air oven in such a place where the airflow around the blower motor is not restricted. Doing so ensures proper airflow inside the oven.

Sterilization control for hot air oven

Biological controls: 10^6 spores of Bacillus subtilis subsp.

Biochemical control: Browne's tube No. 3 shows a green color after sterilization at 160°C for 60 minutes (color changes from red to green).

Physical control: Thermocouples and temperature chart recorder used.

Precautions during autoclaving

- ▶ Sterilize dry substances.
- ▶ It shouldn't be overloaded.
- ▶ Rubber goods, fabrics, any inflammable or volatile substances should not be put inside the oven.
- ▶ The oven is allowed to cool gradually for about 2 hours or up to 40°C before the door is opened.