

# What is Laboratory Hot Water Bath?

A hot water bath or Laboratory Hot water bath is one of the essential instruments of a laboratory. It's normally used for incubation of test samples underwater at constant temperature (hot or cold) over a long period of time.

A hot water bath features a large container with heated water. The design configurations, sizes, and dimensions of a hot water bath always varies. The container size of a laboratory water bath varies from 12 liters to 32 liters for a standard model and 50 -100 liters for a large size water bath.

Its mainly used in clinical and microbiology laboratories, university's lab, environmental research, and even food technology for warming reagents, sample thawing, corrosion tests and bacteriological examinations etc. A water bath can heat a small amount of liquid sample for over a long period of time without changing the concentration of constituents by evaporation.

There are present different types of laboratory water baths and they are used depending on the applications.

When you require balanced high-temperature heating that no more than 100°C, a water bath is a good choice



## **Definition**

A **hot water bath** or **Laboratory hot water bath** is one of the essential instruments of a laboratory, which contains a large container with heated water. It's normally used for incubation of test samples underwater at constant temperature (hot or cold) over a long period of time without changing the concentration of constituents by evaporation.

## **Principle of operation**

Laboratory water bath has a Cu50 temperature sensor, which transfers water temperature to resistance value, and amplified and compared by an integrated amplifier. Then output the control signal, and efficiently control the average heating power of the electric heating tube and maintain water in constant temperature.

Water baths are made of steel and are generally covered with electrostatic paint with high adherence and resistance to environmental laboratory conditions. Water baths have an external panel on which the controls can be found. They also have a tank made of rustproof material with a collection of electrical resistors mounted on their lower part. By means of these, heat is transferred to the medium (water or oil) until reaching the temperature selected with a control device (thermostat or similar). The resistors may be of the following types

- Immersion type. These resistors are installed inside a sealed tube and located on the lower part of the container in direct contact with heating medium.
- External. These resistors are located on the lower part but on the outside of the tank. These are protected by an isolating material which prevents heat loss. This type of resistor transfers the heat to the bottom of the tank through thermal conduction

# Components of a Laboratory Hot Water Bath

- 1. Container or Tank Bath:** In the container, the test samples are kept in hot water for a long period of time. The container of a Laboratory Water Bath is made up of insulated metal such as stainless steel.
- 2. Container Lid:** The lid helps to keep covering the container, so that water does not evaporate out of it. It's mainly made up of heat resistant glass or insulated metal.
- 3. Heater:** A laboratory water bath contains a Cu50 temperature sensor, which helps to generate heat.
- 4. Thermometer:** This helps to check the temperature of the water bath. It can be inbuilt or placed individually.
- 5. Thermostat or regulator:** A thermostat helps to maintain the temperature of a water bath at a constant level.
- 6. Propeller or stirrer device:** It helps to circulate the water inside the water bath (Found in Circulating water baths).
- 7. Outlet:** It helps to get the water out of the container.
- 8. Indicator light:** All water bath should contain an indicator light. When the light is on the water bath is heating. If the water bath reaches the required temperature the light will be turn off to maintain the constant temperature.

## Controls of a Laboratory Hot Water Bath

1. **Temperature controller:** All water baths contain a temperature controller it should be digital or dial.
2. **Safety Controller:** Most of the water baths contain a safety controller, which is mainly located above the temperature controller or associated with the indicator light. A Safety controller helps to set a maximum temperature which the water bath should attain. If somehow the water bath is able to reach the temperature which is set by the safety controller, then the safety light will be turn on. It is impossible for a water bath to reach the temperature higher than the safety settings even the temperature setting is higher.
3. **Shaking Controller:** A shaking controller only found in a shaking water bath. This may allow us to speed up and stop or turn the shaker on.

## Application of Water Bath

- Used for incubation of cell culture.
- Water Bath also used as a heat source for flammable chemicals.
- It is used to facilitates chemical reactions.
- Used to heat up chemical reagents.
- Used for the melting of some substance.
- It is used to increase the solubility of some insoluble substances.

# Types of Water Hot Bath

There are present three types of water bath. They are divide based on their applications.

## 1. Shaking water bath

This type of water bath has an extra control for shaking, which help in the movement of hot water and liquid test sample. This shaking features of a shaking water bath can be turned on or off. In microbiological laboratories, a shaking water bath helps in the incubation of a growing culture with proper air circulation.

A shaking Water bath has some key benefits such as,

- user-friendly operation via keypad.

- It has convenient bath drains.

- It has a controller to adjust the shaking frequencies.

- It contains a bright LED-display with good visibility.

- It has an optional lift-up bath cover.

- power switch integrated in keypad and warning and cut-off protection for low/high temperature.

## 2. Circulating water bath

Stirrers or circulating water bath is used for enzymatic and serologic experiments. In the circulating water bath, the hot water is thoroughly circulated throughout the bath, which is resulting in a more uniform temperature.

## 3. Non-circulating water bath

Non-circulating water baths rely primarily on convection instead of water being uniformly heated, which results in a less accurate in terms of temperature control.

# **WATER BATH OPERATION**

## **Installation**

1. Install the water bath close to an electrical outlet. The outlet must have its respective ground pole in order to guarantee the protection and safety of the operator and the equipment. Water baths generally operate at 120 V/60 Hz or 230 V/60Hz. Its installation and use is facilitated by a sink close by for supplying and draining of water.
2. Verify that the location selected is levelled and has the necessary resistance to safely support the weight of the water bath when it is full of liquid.
3. Ensure that the location has a suitable amount of space for putting the samples and the accessories required for the normal operation of the water bath.
4. Avoid placing the water bath where there are strong air currents which can interfere with its normal operation. For example: in front of an air-conditioning unit or window

## Using the water bath

Before using the water bath, verify that it is clean and that accessories needed are installed. The steps normally followed are:

1. Fill the water bath with fluid to keep the temperature constant (water or oil). Verify that once the containers to be heated are placed, the fluid level is between 4 and 5 cm from the top of the tank.
2. Install the control instruments needed, such as thermometers and circulators. Use additional mounts provided for this purpose. Verify the position of the thermometer's bulb or thermal probe to ensure that the readings are correct.
3. If water is used as the warming fluid, verify that it is clean. Some manufacturers recommend adding products which prevent the formation of fungus or algae.
4. Put the main switch N° 1 in the ON position (the numbers identifying the controls herein correspond to those shown in the diagram). Some manufacturers have incorporated controls with microprocessors which initiate auto-verification routines once the ON switch is activated.
5. Select the operation temperature using the Menu N° 2 button and the buttons for adjusting the parameters.
6. Select the cut-off temperature (in water baths with this control). This is a safety control which cuts off the supply of electricity if it exceeds the selected temperature. This is selected also by using the menu button and is controlled by the parameter adjustment buttons.
7. Avoid using the water bath with the substances indicated below:
  - Bleach.
  - Liquids with high chlorine content.
  - Weak saline solutions such as sodium chloride, calcium chloride or chromium compounds
  - Strong concentrations of any acid.
  - Strong concentrations of any salt.
  - Weak concentrations of hydrochloric.
  - Deionized water, as it causes corrosion and perforation in the stainless steel.

# Safety

1. Avoid the use of the water bath in environments where there are flammable and combustible materials. The equipment has components (resistors generating very high temperatures) which could start an accidental fire or explosion.
2. Always connect the equipment to an electrical outlet with a ground pole to protect the user and the equipment from electrical discharges. The electrical connection must comply with the required norms of the country and the laboratory.
3. Use the water bath exclusively with non-corrosive or non-flammable liquids.
4. Use personal protective elements when working with the water bath. The bath has resistors which can cause burns if inadvertently touched, even a considerable time after turning off the equipment.
5. When working with substances that generate vapors, place the water bath under a chemical hood or in a well ventilated area.
6. Remember that liquids incubated in the water bath tank can produce burns if hands are inadvertently placed inside it.
7. Take into account that the water bath is designed for use with a liquid inside the tank. If the inside is dry, the temperature of the tank can become very high. Use the diffusing tray for placing the container inside of the filled tank of the water bath. This has been designed for distributing the temperature in a uniform way.
8. Avoid using the water bath if any of its controls is not working, e.g. the temperature or limit controls



# Maintenance

**Warning:** Before carrying out any maintenance activity, disconnect the equipment from the electrical feed outlet. Water baths are equipment whose maintenance is simple. The recommended routines mainly focus on the cleaning of external components. The most common routines are featured next.

## Cleaning

### Frequency: Monthly

1. Turn off and disconnect the equipment. Wait until it cools to avoid the risk of burns and accidents.
2. Remove the fluid used for heating. If it is water, it can be poured through a siphon. If it is oil; collect into a container with an adequate capacity.
3. Remove the thermal diffusion grid located at the bottom of the tank.
4. Disassemble the circulator and clean to remove scale and potential algae present.
5. Clean the interior of the tank with a mild detergent. If there is any indication of corrosion, use substances for cleaning stainless steel. Rub lightly with synthetic sponges or equivalent. Avoid using steel wool to remove rust stains as these leave particles of steel which could accelerate corrosion.
6. Avoid bending or striking the temperature control capillary tube generally located at the bottom of the tank.
7. Clean the exterior and interior of the water bath with clean water.

**Lubrication Frequency: Daily** For water baths with an agitation unit or circulator system: Lubricate the axis of the circulator's electric motor. Put a drop of mineral oil on the axis so that a good lubricating condition is maintained between the motor's bearings and its axis. Periodic

**inspection Frequency: Quarterly** Check the thermometer or temperature controls every three months using known standards. If no reference standard is available, use an ice/water mixture and/or boiling water. Note that the thermometer or the water bath temperature controls should also be checked when the equipment is first installed after purchase.

#### CHAPTER 5 WATER BATHS

TROUBLESHOOTING TABLE		
PROBLEM	PROBABLE CAUSE	SOLUTION
There is no power to the instrument.	The water bath is disconnected.	Connect the water bath.
	The switch is defective.	Change the switch.
	The fuse is defective.	Substitute the fuse.
The water bath is not getting hot.	The temperature control not set.	Set the temperature control.
	The resistor(s) is/are defective.	Change resistor(s).
	The limit control is not set	Set the limit control.
The temperature is higher than that selected.	The temperature control is defective.	Change the temperature control if required.
	Verify the selection of the parameters.	
The samples are warmed slowly.	The tank is empty or contains very little fluid.	Fill the tank up to the recommended level.
The temperature is increasing very slowly.	The resistor(s) is/are defective.	Change the resistor(s).
	The temperature control is defective.	Substitute temperature control.