



ANDEAN HEALTH ORGANIZATION - HIPÓLITO UNANUE AGREEMENT

PROGRAM: "STRENGTHENING OF THE TUBERCULOSIS LABORATORY DIAGNOSIS IN THE REGION OF THE AMERICAS"

PREVENTIVE MAINTENANCE FOR TUBERCULOSIS LABORATORY EQUIPMENT



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PREVENTIVE MAINTENANCE OF TUBERCULOSIS LABORATORY EQUIPMENT

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INDEX

5.....	Equipment List
6.....	Preventive Maintenance for Tuberculosis Laboratory Equipment (PMTLE)
9.....	Autoclaves
16.....	Balance
19.....	Water-bath
21.....	Heat block
23.....	Biological Safety Cabinets
28.....	Centrifuge
31.....	Inspissator
33.....	Water distiller
35.....	Freezer/refrigerator
38.....	Drying oven
40.....	Incubator
43.....	pH meter
45.....	Light microscope/ fluorescence microscope
47.....	Pipette
49.....	Thermal cycler
51.....	BACTEC MGIT
53.....	GeneXpert
56.....	GT-Blot (for LPA)
57.....	TwinCubator (for LPA)
59.....	User's Basic Preventive Maintenance for TB Laboratory Equipment Summary
63.....	Bibliography

EQUIPMENT LIST

General laboratory equipment:

- Autoclave
- Balance
- Water-bath
- Heat block
- Biological Safety Cabinets
- Centrifuge
- Inspissator
- Water distiller
- Freezer/refrigerator
- Drying oven
- Incubator
- pH meter
- Light microscope/ fluorescence microscope
- Pipette
- Thermal cycler

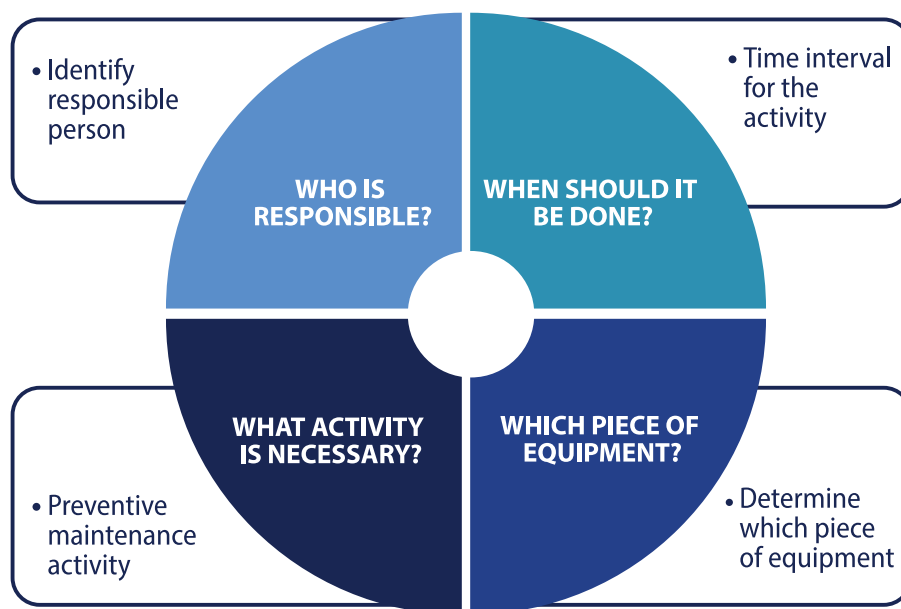
Specialized equipment for a TB laboratory:

- BACTEC MGIT
- GeneXpert
- TwinCubator (for LPA)

PREVENTIVE MAINTENANCE FOR TUBERCULOSIS LABORATORY EQUIPMENT (PMTLE)

This document has been developed to provide a practical guide for the planification and implementation of an equipment maintenance program to be carried out by Tuberculosis laboratory workers. Implementing these activities will help ensure a prolonged lifespan of the equipment. Proper functioning of equipment is fundamental for ensuring accurate results of diagnostic and research activities. Therefore; calibrating, certifying and maintaining TB laboratory equipment on a regular basis is essential.

The Preventive Maintenance for Tuberculosis Laboratory Equipment (PMTLE) Plan provides a table for each key piece of equipment in a Tuberculosis laboratory to keep regular maintenance organized and accessible to its user. In order to implement this PMTLE, the laboratory manager should provide answers to the following four key questions:



Equipment management is a key element of a Quality Management Program for any laboratory. Routine maintenance, calibration and repairs require formal documentation and monitoring in order to ensure quality performance and enhance the lifespan of each piece of equipment. Using the correct piece of equipment, its proper installation, verification and validation will ensure reliable, accurate and timely results.

WHICH? (Piece of equipment that requires maintenance)	WHAT? (Maintenance activity that is required)	WHEN? (Regularity in which maintenance activity should be performed)	WHO? (Designated laboratory person to perform the activity)
EQUIPMENT	PROCEDURE	TIME INTERVAL (FREQUENCY)	RESPONSIBLE PERSON

A PMTLE program can help the laboratory achieve a high level of performance, prolong the lifespan of the equipment, reduce service interruption due to equipment breakdown and failure, reduce variations in results and guarantee a safe working environment. Its implementation requires the following steps:

1. Assigning a responsible person for all activities;
2. Ensuring all manufacturer's instructions and operation manuals are available on-site;
3. Developing a written protocol to ensure proper equipment calibration, inspection or problem solving, and routine function checks;
4. Creating templates, logs and generating reports;
5. Filing documentation;
6. Providing well-documented staff training and refresher training programs

All laboratories should keep an inventory log book created for all laboratory equipment in which the following parameters should be recorded:

- Equipment name, make, model, inventory number and serial number;
- Dates of purchase, reception and installation;
- Manufacturer and vendor, and their contact information;
- Technical specifications (such as voltage, capacity, size);
- Location within the laboratory, identification of electrical outlet and switch in the control panel;
- Dates of calibration and validation;
- Location of equipment's manual and warranty (considering expiration date)

A Standard Operating Procedure (SOP) should be developed for each piece of equipment. These SOPs can be based on templates recommended by the World Health Organization (WHO), but they should be customized considering the manufacturer's instructions for each piece of equipment.

Each piece of equipment should have its own record with information regarding routine calibrations, maintenance activities, problem reports, service and repairs, and function checks. These records should be kept during the lifespan of the equipment, and must comprehend all problems regarding its function, including:

- The date on which the problem occurred.
- The date on which the piece of equipment was removed from service.
- The cause of breakdown or failure (error codes or a description of what happened when the piece of equipment stopped working properly, i.e., sounds, leaks, vibrations, etc.).
- A problem-solving report.
- Whether its decontamination is necessary or not.
- The date on which the service provider was contacted (if needed).
- The date on which the service provider replied
- Corrective actions conducted
- The date on which the piece of equipment was put back into use
- Changes in maintenance or function checks

The Preventive Maintenance activities to be carried out by the TB Laboratory Equipment Users are described hereinafter. **It is necessary for the Laboratory Biosafety Officer to conduct a risk assessment prior to all activities, and to provide the laboratory staff with the necessary Personal Protective Equipment (PPE) according to Biosafety guidelines.**

AUTOCLAVES

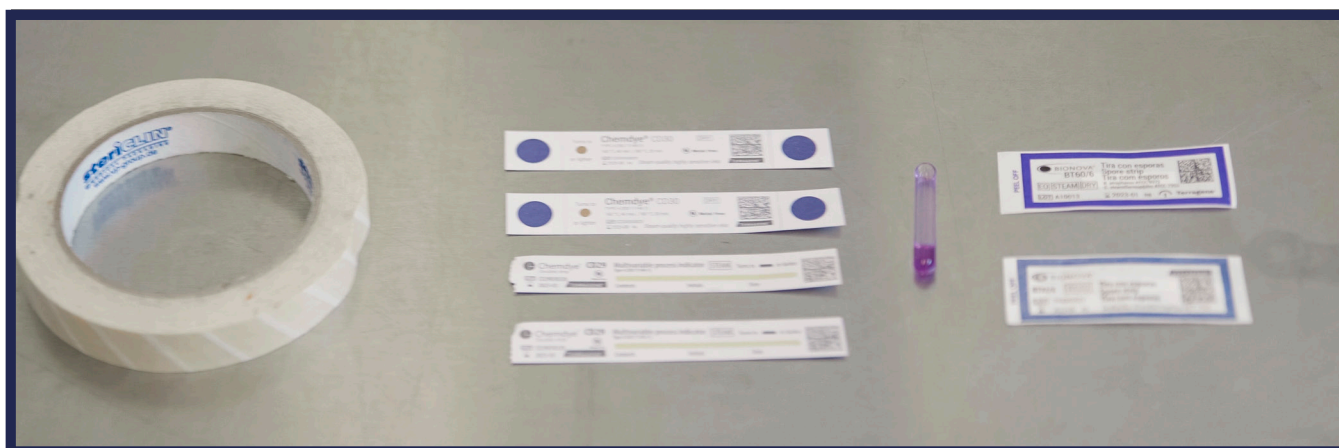
Autoclaves play a key role in the sterilization and decontamination of infectious materials (e.g., objects, media, waste) in Tuberculosis laboratories. Maintenance of autoclaves implies daily and weekly procedures that can be carried out by users themselves, and annual or biannual procedures that can only be performed by specialized technical personnel (e.g., engineer, biomedical engineer, etc.).

The sterilization process should be routinely monitored by its user, keeping a daily record in the log book of the cycle time, temperature and pressure of sterilization. Physicochemical and biological indicators should be used for this.

- ▶ **Indicator tapes;** are indicators with strips that react when exposed to temperature and time; these should be used in every cycle. Heat-sensitive indicators by themselves are not sufficient to assess whether the sterilization temperature (121°C) has reached the center of the load.
- ▶ **Chemical indicators;** Sensitive chemicals are used to assess physical conditions such as temperature (autoclave tape, steam chemical process indicators) or steam penetration (Bowie–Dick test) during the sterilization process.

Chemical indicators are heat-sensitive (i.e., they change color depending on the temperature). An internal chemical indicator should be placed inside every package, and an external indicator should be used when the internal indicator cannot be seen from the outside of the package.

- ▶ **Multiparameter internal indicators;** measure from two to three parameters and can provide a more reliable indication that the necessary conditions have been met during the process (e.g., autoclave test strips with time, steam and temperature control). Manufacturer instructions should be consulted for proper use and placement.
- ▶ **Biological indicators;** directly determine whether the most resistant microorganisms, which are endospore-forming (i.e., *Geobacillus* or *Bacillus* species) are viable after the cycle. These indicators should be used periodically (at least once a week) in order to assess the correct functioning of the cycles. In addition to the routine monitoring, they should also be used under the following conditions:
 - Whenever a new packing material or tray is being used;
 - After training new sterilization personnel;
 - After any equipment repairs;
 - After any modification to the loading procedure



CHEMICAL INDICATOR / PHYSICAL CHEMICAL INDICATOR / BIOLOGICAL INDICATOR

The autoclave is a piece of equipment that requires permanent monitoring and preventive maintenance due to its great number of components and its integrated technology.

These maintenance activities are focused on basic routines that can be carried out by autoclave's users. For a detailed maintenance, manufacturer's instructions should be followed.

User's Basic Preventive Maintenance for TB Laboratory Equipment			
EQUIPMENT	PROCEDURE	FREQUENCY	RESPONSIBLE PERSON
ALL AUTOCLAVES	Cleaning internal chamber	Daily	Assigned responsible laboratory personnel
PASS-THROUGH AUTOCLAVE	Cleaning and checking the filter on the bottom of the chamber	Biweekly	Assigned responsible laboratory personnel
PASS-THROUGH AUTOCLAVE	Cleaning and lubricating door's gasket	Weekly	Assigned responsible laboratory personnel
PASS-THROUGH AUTOCLAVE	Purging (draining) the vapor generator	Weekly	Assigned responsible laboratory personnel
PASS-THROUGH AUTOCLAVE	Verifying the compressed-air pressure regulator of pneumatic valves	Bimonthly	Assigned responsible laboratory personnel



**PASS-THROUGH
AUTOCLAVE**

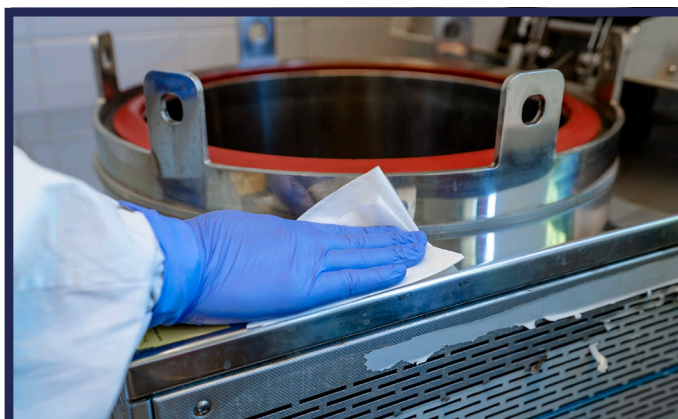
**VERTICAL
AUTOCLAVE**

Cleaning the internal chamber:

Cleaning the chamber will prevent its possible corrosion and the accumulation of unwanted dirt.

1. Turn off the equipment and make sure that both internal and external chambers are not pressurized (check respective manometers). In vertical autoclaves, check that chambers are not hot and remove all remaining water from inside.
2. Detach all removable parts for a thorough cleaning.
3. Clean the chamber's surface with a piece of cloth dampened with water.
4. Clean the surface with the specific decontaminant used routinely. Check closely for any sign of black specks, which should be eliminated in the cleaning process, since, in time, they might become vestiges of corrosion. Repeat the same procedure with all removable parts (guides, shelves, trays).
5. Rinse surface thoroughly with a piece of cloth dampened with water, trying not to leak water through the bottom filter. Repeat the same procedure for all removable parts and place them back into the piece of equipment.
6. Record the procedure in the Laboratory's Maintenance and Cleaning log book.

NOTE: It is recommended that 70% ethanol should be used for all stainless-steel surfaces in order to avoid corrosion; if chlorine solutions are used, clean with plenty of water afterwards in order to prevent any remnant from damaging the equipment.



**CLEANING OF INTERNAL
AND EXTERNAL PARTS OF
THE VERTICAL AUTOCLAVE**



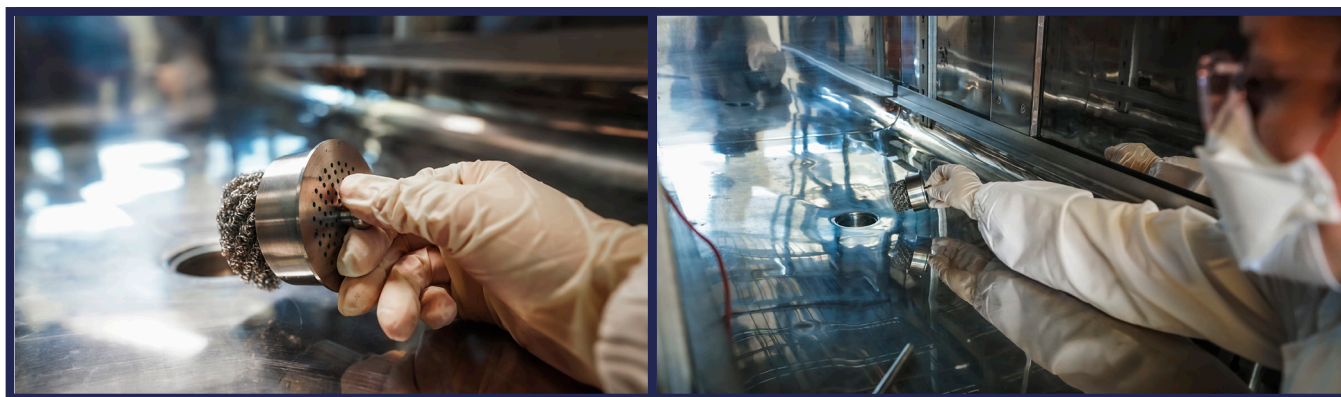
**CLEANING OF INTERNAL
AND EXTERNAL PARTS OF
PASS-THROUGH AUTOCLAVE**



Cleaning and checking the filter on the bottom of the chamber:

This verification and cleaning process rules out the possibility of any particles passing through the chamber's draining system.

1. Turn off the autoclave and make sure that both internal and external chambers are not pressurized (check respective manometers).
2. Manually remove the bottom filter, taking it by its bolt and pulling it upwards.
3. Spray with routine decontaminant.
4. Wash filter and mesh with plenty of warm water and detergent.
5. Rinse with plenty of water and reinstall it.
6. Record the procedure in the Laboratory's Maintenance and Cleaning log book.



CHAMBER BOTTOM FILTER REMOVAL FOR CLEANING

Cleaning and lubricating door's gasket:

In pass-through / double-door autoclaves, each door has a tubular silicone gasket, whilst vertical autoclaves have a gasket at the top; these gaskets allow autoclave doors to be hermetically sealed.

If gaskets are dirty, damaged or lack lubrication, the closing of doors or their hermetic seal may fail, and therefore; the autoclave will not function properly.

1. Turn off the autoclave and, in the case of pass-through autoclaves, make sure that both internal and external chambers are not pressurized (check respective manometers).
2. Using the specific tool instructed by the manufacturer (do not use sharp elements that may damage equipment), remove gasket from its housing. (Being extremely careful not to do it from the joint, since there is less resistance in that area).
3. Clean gasket using a cloth dampened with isopropyl alcohol.
4. Verify the integrity of the gasket (it should show no signs of dirt, punctures or perforations).

5. Clean gasket housing with a cloth dampened with isopropyl alcohol, getting rid of all possible grime, and then let evaporate for a few minutes.
6. Lubricate the gasket housing with silicone spray, then put the gasket back in, bearing in mind that the gasket joint should be located in the middle of the upper edge.
7. Use silicone spray across the front of the gasket.
8. Record the procedure in the Laboratory's Maintenance and Cleaning log book.



CLEANING AND LUBRICATION OF AUTOCLAVE JOINT

This process should be carried out on a monthly basis, but gasket lubrication prior to a sterilizing cycle will depend on the autoclave's usage. It is recommended that gaskets should be sprayed with silicone every 8 cycles.

NOTE: If gasket appears worn or torn, specialized technical personnel should be notified for its replacement.

Purging (draining) the vapor generator:

Draining the vapor generator eliminates salts concentrated by the evaporation of the supply water (sediments). These accumulations shorten the lifespan of the vapor generator, as well as that of the valves, pipes and heating resistors.

1. Turn on autoclave and wait until the pressure of the generator is approximately 1 Bar (check respective manometer).
2. Disconnect autoclave.
3. Open the vapor generator manual drain valve completely for 5 seconds and then close it once again (this will evacuate the pressurized hot water contained in the generator). Repeat this step four times.
4. Then, open the drain valve completely, allowing the vapor pressure to drop down to zero (check respective manometer).
5. Keeping the drain valve open, turn on autoclave and keep it running during two or three minutes (during this time, the water pump will be functioning).
6. Disconnect autoclave and close the generator manual drain valve.

NOTE: This procedure applies to all autoclaves that do not have automatic purging; the steps described are specific to the Hogner Pass-through Autoclave; the need for manual purging should be checked with the manufacturer, since it may vary depending on make and model.

BALANCE

Precision and analytical balances are important for preparing media and reagent solutions. These instruments are very sensitive and need regular maintenance and periodic calibration.

User's Basic Preventive Maintenance for TB Laboratory Equipment			
EQUIPMENT	PROCEDURE	FREQUENCY	RESPONSIBLE PERSON
BALANCES	Cleaning plates and external surfaces	Weekly	Assigned responsible laboratory personnel
	Verifying that balance is levelled	Monthly	Assigned responsible laboratory personnel
	Verifying the zero setting	Monthly	Assigned responsible laboratory personnel



ANALYTICAL BALANCE



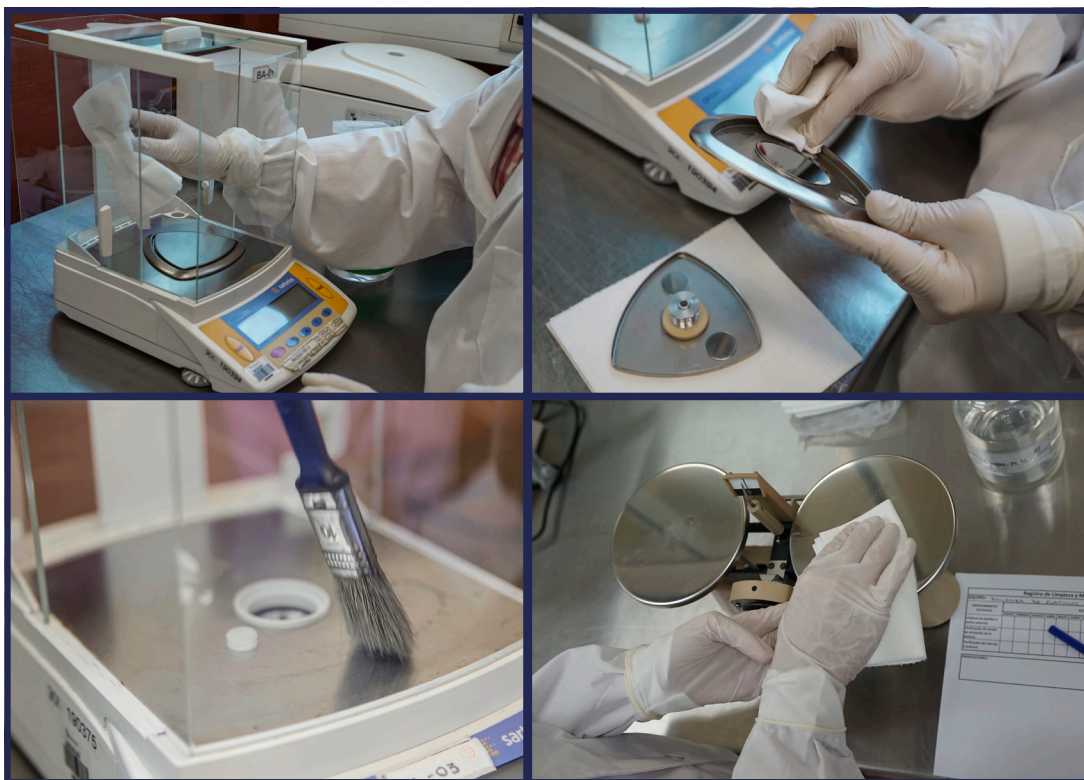
ELECTRONIC BALANCE



TWO-PAN BALANCE

Cleaning plates and external surfaces

1. Clean weighing plate so that it is kept free of dust. A clean cloth should be used for this, which may be dampened with distilled water or 70% ethanol.
2. If it is necessary to remove any stain, a mild detergent may be used.
3. Use a fine camel hair brush to remove any dust particles from the weighing plate.
4. Clean weighing chamber, both externally and internally. Verify that glass is dust-free.
5. Verify the integrity of the balance and its legs / support.
6. Record the procedure in the Laboratory's Maintenance and Cleaning log book.



INTERNAL AND EXTERNAL CLEANING OF BALANCES

Verifying that balance is levelled

1. Verify that the adjustment mechanism on the front door (or side doors) of the weighing chamber works adequately (in precision balances). The door is considered in good operating condition when there is no visible damage or defect present and when it is properly placed over the supporting area, preventing any air current from slipping through and affecting the readings.
2. Verify that balance is levelled; precision balances have a spirit level indicator that consists in centering a bubble inside a circle marked by the manufacturer. Users can level the balance by adjusting its legs until the bubble is centered.



**BALANCE SPIRIT
LEVEL INDICATOR**

Verifying the zero mechanism

1. It is considered to be in good operating condition when the proper zero identification can be obtained and maintained.



**VERIFICATION OF THE
ZERO OF THE BALANCE**

WATER-BATH

In a Tuberculosis laboratory, the water-bath is used for inactivating *M. tuberculosis* cultures before DNA extraction. Water-baths are normally used between room temperature and 100°C; and they have a capacity from 2 to 30 liters.

User's Basic Preventive Maintenance for TB Laboratory Equipment			
EQUIPMENT	PROCEDURE	FREQUENCY	RESPONSIBLE PERSON
WATER-BATH	Cleaning interior and exterior surfaces	Monthly	Assigned responsible laboratory personnel
	Lubrication	Daily	Assigned responsible laboratory personnel
	Recording temperature and water level	Daily	Equipment User



THERMOSTATIC BATH



WATER-BATH

Cleaning interior and exterior surfaces

1. Turn off and disconnect the water-bath. Wait until it cools down to prevent the risk of accidental burns.
2. Remove the fluid used for heating. If it is water, it can be poured into a siphon. If it is oil; collect into a container with adequate – volume – capacity.
3. Remove the thermal diffusion grid at the bottom of the tank.

4. Clean the interior of the tank using a mild detergent. If there is any indication of corrosion present, rub lightly with synthetic sponges or any equivalent. Avoid using steel wool to remove rust stains, since they leave steel particles that may accelerate corrosion.
5. Record the procedure in the Laboratory's Maintenance and Cleaning log book.



**INTERNAL AND EXTERNAL
CLEANING OF WATER-BATHS
REMOVING ITS PARTS**

Lubrication

1. Lubricate the axis of the agitator's electric motor. Place a drop of mineral oil on the axis so that a good lubrication condition is maintained between the motor's bearings and its axis. (This applies to water-baths with an agitation unit).

Recording temperature and water level

1. Before each use, verify that the water level is adequate, within the minimum and maximum indicated in the water-bath.
2. Record the selected temperature with each use.
3. Record any observation or equipment failure.

HEAT BLOCK

In many cases, heath blocks are used as a replacement of water-baths in a Tuberculosis Laboratory. Heath blocks are better than the latter since they are able to maintain the desired temperature more precisely.

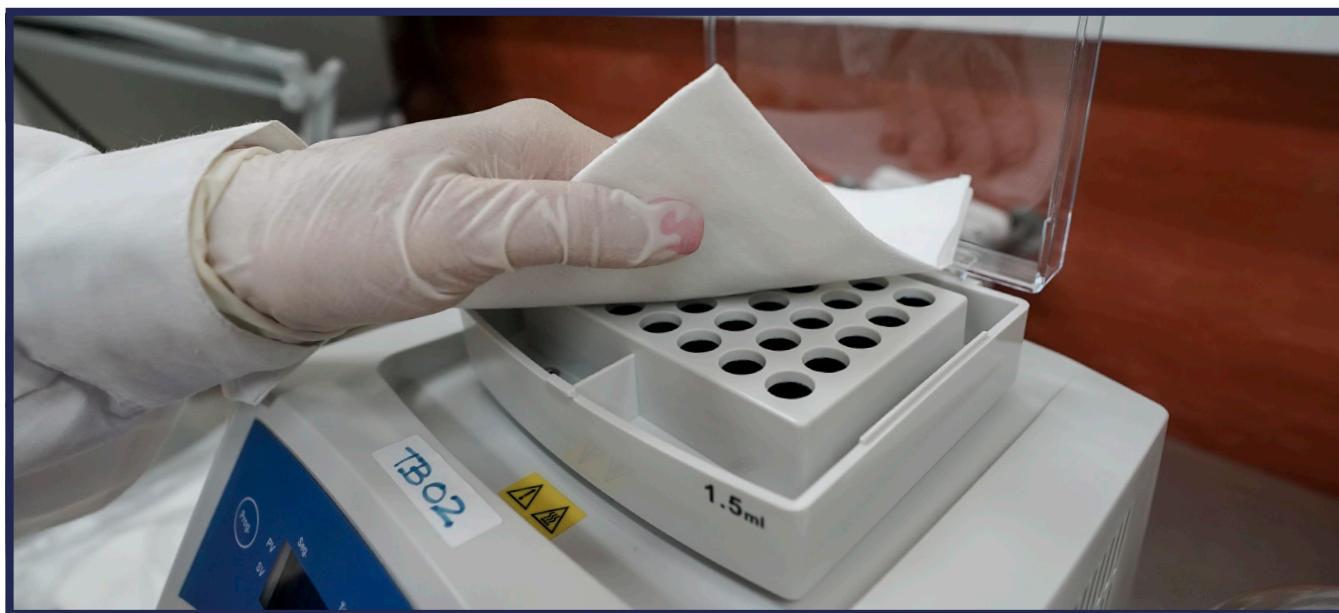
User's Basic Preventive Maintenance for TB Laboratory Equipment			
EQUIPMENT	PROCEDURE	FREQUENCY	RESPONSIBLE PERSON
HEAT BLOCK	Cleaning interior and exterior surfaces	Monthly	Assigned responsible laboratory personnel
	Recording temperature and time	Daily	Equipment User



HEATH BLOCK / HEATHING BLOCK / DRY BATH

Cleaning interior and exterior surfaces

1. Turn off and disconnect the heath block. Wait until it cools down to prevent the risk of accidental burns.
2. Clean the interior of the tank using a mild detergent. If there is any indication of corrosion present, rub lightly with synthetic sponges or any equivalent. Avoid using steel wool to remove rust stains, since they leave steel particles that may accelerate corrosion.
3. The unit can be cleaned using a cloth dampened with a solution of mild soap and water. The unit should never be submerged in any liquid.
4. Record the procedure in the Laboratory's Maintenance and Cleaning log book.



Recording temperature and time

1. Record the selected time and temperature with each use.
2. Record any observation or equipment failure.

BIOLOGICAL SAFETY CABINETS

Biological Safety Cabinets (BSC) are the most important Biosafety equipment when working with air-borne infectious substances.

The proper functioning of BSCs and Good Laboratory Practices ensure safety for workers, therefore, this equipment should be monitored and maintained on a regular basis. A specific log book should be created for recording maintenance procedures.

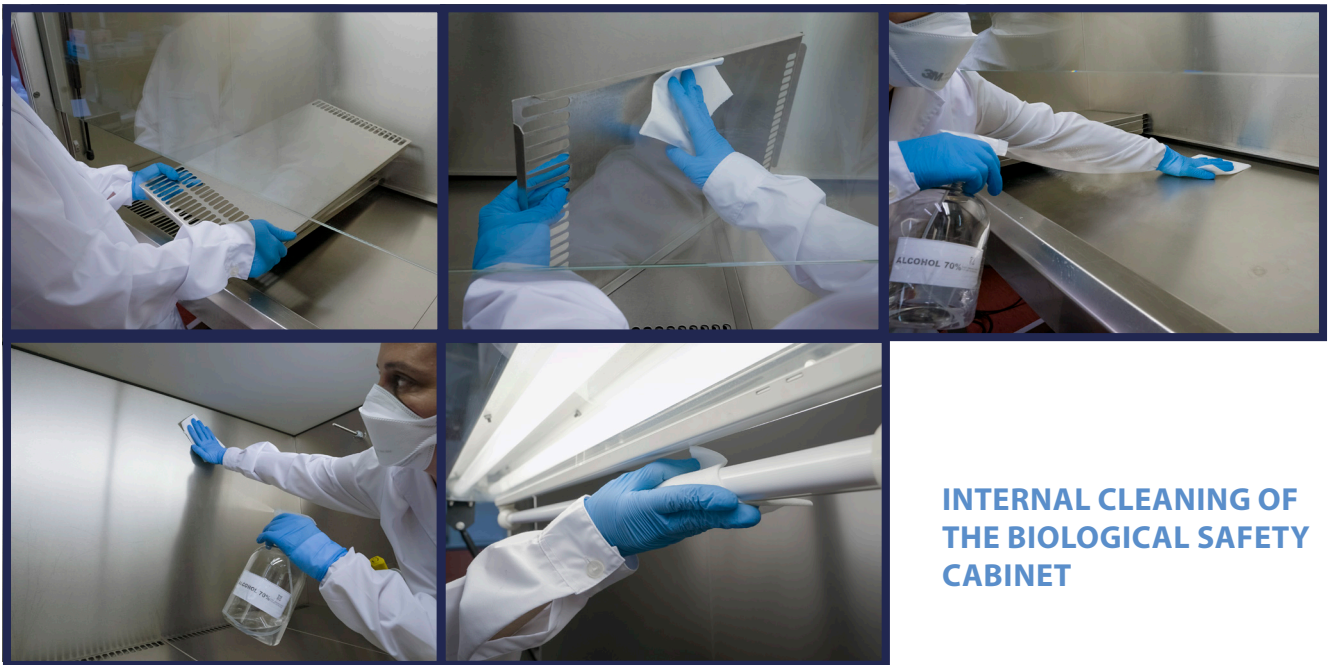
User's Basic Preventive Maintenance for TB Laboratory Equipment			
EQUIPMENT	PROCEDURE	FREQUENCY	RESPONSIBLE PERSON
BIOLOGICAL SAFETY CABINET	Cleaning interior surfaces	Daily	Equipment User
	Verifying operation parameters	Daily	Equipment User
	Cleaning exterior surfaces and internal parts	Monthly	Assigned responsible laboratory personnel
	Air sampling on agar plates	Biannually	Assigned responsible laboratory personnel
	Visual examination of airflow	Monthly	Assigned responsible laboratory personnel



CLASS II TYPE A2 BIOLOGICAL SAFETY CABINET WITH CANOPY CONNECTION

Cleaning interior surfaces

1. Clean all interior surfaces of the BSC with 70% ethanol before and after its use.
2. Lift inner tray from the work surface and clean the space underneath it with 70% ethanol.
3. Clean UV lamp using a cloth dampened with 70% ethanol (UV light acts on contact with the surface, if the lamp is dirty, it has no impact on it and it creates a false sense of security).
4. Record the procedure in the Laboratory's Maintenance and Cleaning log book.



**INTERNAL CLEANING OF
THE BIOLOGICAL SAFETY
CABINET**

Verifying operation parameters

1. Verify that the following parameters are within the acceptable criteria suggested by the manufacturer: Inflow/downflow velocity, and led indicator or pressure differential, depending on make and model.
2. Verify that the BSC is certified (annual certification). If certification has expired, request a recertification to a qualified engineer/technician.
3. Record operation readings and values, and the responsible user in the daily BSC log book.

Cleaning exterior surfaces and internal parts.

1. Clean BSC thoroughly
2. Clean the exterior surface of the BSC with a lint-free cloth and 70% ethanol, including the top of the unit, but avoiding the extraction filter.

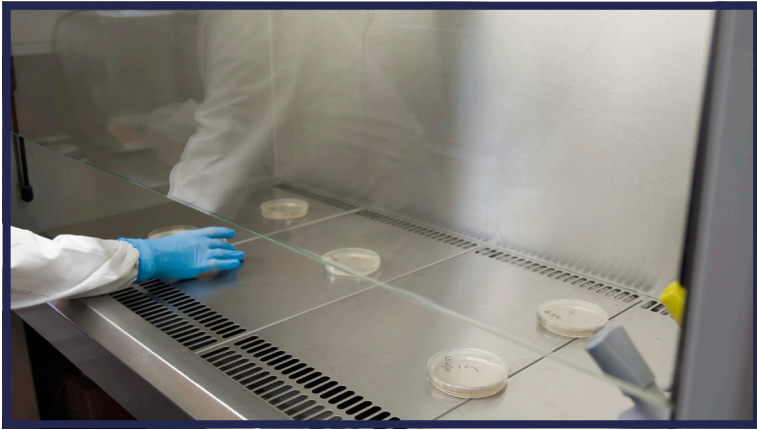
3. Lift inner tray from the work surface and clean it with 70% ethanol.
4. Remove the work tray lid hinges and clean all parts with 70% ethanol.
5. Clean inferior tray with 70% ethanol, making sure to reach all parts of the BSC, including its bottom.
6. Record the procedure in the Laboratory's Maintenance and Cleaning log book.



**INTERNAL AND EXTERNAL
CLEANING OF THE
BIOLOGICAL SAFETY
CABINET**

Air sampling on Agar plates

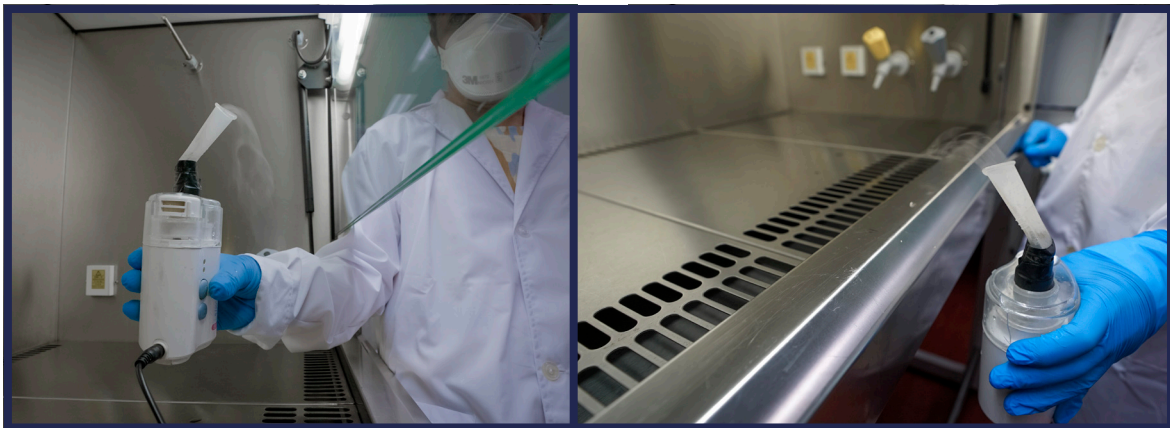
1. Organize work surface, bearing in mind the distances suggested by the manufacturer.
2. Place Agar plates while BSC is on, and leave them exposed for an hour.
3. Put the lids back on the plates and incubate at 37°C for 48 hrs.
4. Observe results in order to assess the BSC cleanliness.



**PLACING THE AGAR PLATES
INTO THE BIOLOGICAL
SAFETY CABINET**

Visual examination of airflow

1. Use a smoke generator to visualize the BSC airflow patterns.
2. Direct smoke through the front of the BSC with the purpose of visualizing the airflow patterns. Smoke should go through the front grille and nothing should come out of it.
3. Then, direct smoke through the central line from one side of the BSC to the other, about 10cm above the glass opening, and observe the laminar flow behavior. Smoke should be drawn in downwards through the grilles at the front and back. Smoke should never travel sideways in order to avoid cross-contamination.
4. Record procedure in the daily BSC log book.



**VISUAL DOWNFLOW CONTROL -
air descends without going up nor
generating eddy**

**INFLOW CONTROL -
air enters into the cabinet and gets the
grille without leaking into the work zone**



CANOPY CONTROL -
air enters through the canopy and
goes to the outlet duct, without
returning to the laboratory

RECORD IN THE LABORATORY
EQUIPMENT CLEANING AND
MAINTENANCE RECORD SHEET

CENTRIFUGE

The centrifuge is used for concentrating samples. Centrifugation at the correct speed and temperature is important for preserving viable Mycobacteria in the sample. These parameters should be recorded in a specific log book for each procedure and use.

User's Basic Preventive Maintenance for TB Laboratory Equipment			
EQUIPMENT	PROCEDURE	FREQUENCY	RESPONSIBLE PERSON
CENTRIFUGE	Cleaning rotor compartment and centrifuge surfaces	Daily	Equipment User
	Cleaning external surface and dismounting centrifuge parts	Weekly	Assigned responsible laboratory personnel
	Verifying centrifuge locking mechanism	Daily	Equipment User
	Verifying state of rubber rings (O-rings) (For rotors with safety mechanisms)	Daily	Assigned responsible laboratory personnel
	Recording temperature (for refrigerated centrifuges.)	Daily	Equipment User



BENCHTOP CENTRIFUGE



FLOORSTANDING CENTRIFUGES



MICROCENRIFUGE

Cleaning rotor compartment and centrifuge surfaces.

1. Clean centrifuge exterior and interior on a regular basis, using soap or a mild detergent and a wet cloth. The following products are recommended: soap, anionic surfactants (detergents) and non-ionic surfactants.

2. After using detergents, eliminate any remnant using a wet cloth.
3. Dry off surfaces immediately after cleaning.
4. If there's water condensation, dry off centrifuge internal chamber with an absorbent cloth.
5. Record the procedure in the Laboratory's Maintenance and Cleaning log book.



**MICROCENTRIFUGE
CLEANING**



**TABLETOP CENTRIFUGE CLEANING
AND BASKET CLEANING INSIDE THE
BIOLOGICAL SAFETY CABINET**

Cleaning external surface and dismounting centrifuge parts.

1. In order to prevent corrosion and changes in materials, rotors and accessories should be cleaned regularly using soap or a mild detergent and a wet cloth. It is recommended to do this at least once a week. Contaminants should be eliminated immediately.
2. After using detergents, eliminate remnants by rinsing with water (only outside the centrifuge) or cleaning with a wet cloth.
3. In order to avoid corrosion as a result of the presence of humidity between the rotor and the motor shaft, the rotor should be dismounted and cleaned at least once a month, and the motor shaft should be greased slightly.
4. Check rotors and accessories for damage or wear caused by corrosion.
5. Make sure rotor has been tightened properly.
6. Record the procedure in the Laboratory's Maintenance and Cleaning log book.

Verifying centrifuge locking mechanism

1. Verifying the locking / safety mechanism of the centrifuge lid is fundamental for guaranteeing operators' safety. This mechanism keeps the centrifuge lid closed while the rotor is rotating.
2. The locking mechanism is considered to be in good condition when the centrifuge lid has no visible damage or defect and it can fully close, resting completely on the supporting surface or frame.

Verifying state of rubber rings (O'rings)

1. Rotors with a safety lid are equipped with a rubber ring (O'ring), which should be visually checked for wear or damage.
2. O'rings will be considered in good condition if: there is no visible deterioration or damage present; O'ring is firmly fixed to the surface and is mounted tightly enough on the contact surface.

Recording temperature

1. With each use, record temperature, speed and time of use.
2. Record any observation or equipment failure.

INSPISSATOR

Inspissators are used for solidifying egg-based media by coagulating egg's protein through heat. The temperature set for the procedure will have a direct impact on the medium quality.

User's Basic Preventive Maintenance for TB Laboratory Equipment			
EQUIPMENT	PROCEDURE	FREQUENCY	RESPONSIBLE PERSON
INSPISSATOR	Cleaning interior and exterior surfaces	Monthly	Assigned responsible laboratory personnel
	Verifying water level. <i>(In case it has any to create humidity)</i>	Daily	Equipment User
	Temperature control	Daily	Equipment User



INSPISSATOR

Cleaning interior and exterior surfaces.

1. In order to prevent corrosion, all equipment parts should be cleaned regularly, using a wet cloth with soap or a mild detergent. It is recommended to do this at least once a month.
2. After using detergent, eliminate any possible remnant by rinsing with water or wiping with a wet cloth.
3. Clean all surfaces using 70% ethanol.
4. Record the procedure in the Laboratory's Maintenance and Cleaning log book.

Temperature control.

1. With each use, record temperature and time of use.
2. Record any observation or equipment failure.

IMPORTANT For inspissators with water-bath, it is convenient to use distilled water (or better yet, double-distilled water) in order to prevent corrosion.

WATER DISTILLER

Laboratory water distillers (also known as distillation units or water stills) purify tap water by controlled vaporization and cooling processes. Distilled water is used for preparing culture media and other reagents.

User's Basic Preventive Maintenance for TB Laboratory Equipment			
EQUIPMENT	PROCEDURE	FREQUENCY	RESPONSIBLE PERSON
WATER DISTILLER	Cleaning interior and exterior surfaces	Monthly	Assigned responsible laboratory personnel
	Cleaning storage tank	Monthly	Assigned responsible laboratory personnel



WATER DISTILLER

Cleaning interior and exterior surfaces.

1. In order to prevent corrosion, all equipment parts should be cleaned regularly, using a wet cloth with soap or a mild detergent. It is recommended to do this at least once a month.
2. After using detergent, eliminate any possible remnant by rinsing with water or cleaning with a wet cloth.
3. Clean all surfaces using 70% ethanol.
4. Record the procedure in the Laboratory's Maintenance and Cleaning log book.

Cleaning storage tank.

- 1.** Remove lid from boiling tank.
- 2.** Perform a visual inspection of the tank's interior walls or the immersion resistors.
- 3.** If there are any solid deposits or sediments present, these should be cleaned to avoid damage to the immersion resistors.
- 4.** Cleaning products and their recommended time of use to remove sediments should be checked with the manufacturer.
- 5.** Add clean water, wash and drain until it is certain that there are no remnants of the chemical product used in the cleaning process or of the sediments removed from the affected surfaces.
- 6.** Record the procedure in the Laboratory's Maintenance and Cleaning log book.

FREEZER/ REFRIGERATOR

Refrigerators and freezers are among the most important pieces of laboratory equipment. They maintain a temperature-controlled environment (refrigerated) for storing various liquids, culture media, reagents and samples.

User's Basic Preventive Maintenance for TB Laboratory Equipment			
EQUIPMENT	PROCEDURE	FREQUENCY	RESPONSIBLE PERSON
FREEZER/ REFRIGERATOR	Cleaning interior and exterior surfaces	Monthly	Assigned responsible laboratory personnel
	Verifying that door gasket and hinges are functional	Monthly	Assigned responsible laboratory personnel
	Cleaning filters	Monthly	Assigned responsible laboratory personnel
	Defrosting	Biannual	Assigned responsible laboratory personnel
	Temperature control	Daily.	Equipment User



FREEZER
-80°C

Cleaning interior and exterior surfaces.

1. To prevent corrosion, all equipment parts should be cleaned using 70% ethanol.
2. Remove shelves and their hinges.
3. Record the procedure in the Laboratory's Maintenance and Cleaning log book.



Verifying that door gasket and hinges are functional.

1. Verify that the unit's door closes properly. It is considered to be in good operating condition when the door has no visible damage or defect, and rests completely on the supporting surface. If the refrigerator / freezer is equipped with a locking mechanism, this should be taken into account during the visual inspection.
2. Verify that door gasket is in good condition. It will be considered as such when there is no visible damage or defect on its surface; it is properly fixed to its supporting surface and allows doors to be hermetically sealed.

Cleaning filters.

1. Filter is considered in good condition when it is not obstructed.
2. Filter must be removed (follow manufacturer's instructions) and cleaned.
3. Record the procedure in the Laboratory's Maintenance and Cleaning log book.



FREEZER FILTER REMOVAL AND CLEANING

Defrosting

1. Remove the contents of the unit and disconnect it.
2. Clean every part of it using 70% ethanol.
3. Thickness of the frost is considered adequate as long as the door can be closed without obstructions and samples can be stored correctly.
4. Record the procedure in the Laboratory's Maintenance and Cleaning log book.

Temperature control

1. Freezers / Refrigerators temperature should be checked on a daily basis.
2. Units are considered in good operating condition if they can reach and maintain the desired temperature. Some units have a digital display, these are considered to be in good operating condition if they allow a clear reading of the parameters without any wrong readings.
3. Record temperature in the Temperature Control log book for Cold Chain Equipment.

DRYING OVEN

In a laboratory, drying ovens (also known as hot air ovens) are used for drying and sterilizing glass and metal containers. Their operating temperature is between room-temperature and 350°C.

User's Basic Preventive Maintenance for TB Laboratory Equipment			
EQUIPMENT	PROCEDURE	FREQUENCY	RESPONSIBLE PERSON
DRYING OVEN	Cleaning interior and exterior surfaces	Biweekly	Assigned responsible laboratory personnel
	Thorough cleaning	Quarterly	Assigned responsible laboratory personnel
	Temperature control	Daily	Equipment User



**DRYING
OVEN**

Cleaning interior and exterior surfaces.

1. To prevent corrosion, all interior and exterior surfaces should be cleaned regularly using 70% ethanol.
2. Record the procedure in the Laboratory's Maintenance and Cleaning log book.

Thorough cleaning

1. Remove all parts of the unit, including its shelves, and take out the hinges. Wash with a mild detergent, let dry, and then clean with 70% ethanol.
2. Record the procedure in the Laboratory's Maintenance and Cleaning log book.



Temperature control

1. With each use, record temperature and time of use.
2. Record any observation or equipment failure.
3. Record the procedure in the daily drying-oven log book.

INCUBATOR

An incubator is a chamber with controlled temperature, atmosphere and humidity; it is used for maintaining live organisms in a suitable environment for their growth.

Some incubators have CO₂ injection for reaching specific atmospheric conditions to support the growth of *Mycobacterium tuberculosis* in a specific medium.

User's Basic Preventive Maintenance for TB Laboratory Equipment			
EQUIPMENT	PROCEDURE	FREQUENCY	RESPONSIBLE PERSON
INCUBATOR	Cleaning interior and exterior surfaces	Monthly	Assigned responsible laboratory personnel
	Thorough cleaning	Annual	Assigned responsible laboratory personnel
	Controlling temperature and incubator's integrity	Daily	Equipment User



**CO₂
INCUBATOR**

Cleaning interior and exterior surfaces.

1. To prevent corrosion, all interior and exterior surfaces should be cleaned regularly using 70% ethanol.
2. Record the procedure in the Laboratory's Maintenance and Cleaning log book.



INTERNAL AND EXTERNAL CLEANING OF INCUBATOR SURFACES

Thorough cleaning.

1. Remove all parts of the unit, including its shelves, and take out the hinges. Wash with mild detergent, let dry, and then clean with 70% ethanol.
2. Record the procedure in the Laboratory's Maintenance and Cleaning log book.

Control temperature and incubator's integrity

1. With each use, record temperature and time of use.
2. The unit is considered to be in good operating condition when there is no damage present during visual inspection; the scale or display can be read properly; and parameters change when subjected to a temperature variation.
3. Hinges are considered to be in good operating condition when there is no visible defect or damage caused by corrosion present; the anchor system appears firmly in place and allows the door to move freely.
4. Door gaskets are considered to be in good operating condition when there is no visible damage or defect present; they are properly fixed to the surface, and they allow doors to be hermetically sealed.

- 5.** Check door's integrity. The door is considered to be in good operating condition when there is no visible damage or defect present and it makes full contact with the supporting area, preventing any air current from affecting the readings. The glass door is considered to be in good operating condition when it is whole, allows for a clear visibility inside the unit, makes full contact with the frame, and its gasket and hinges are fixed firmly in place.
- 6.** Record the procedure in the Incubator daily log book.

PH METER

The pH meter is used to determine the concentration of hydrogen ions, $[H^+]$, in a solution by measuring the difference in electrical potential between the pH electrode and a reference electrode.

pH meters are also known as pH analyzers, pH monitors or potentiometers.

User's Basic Preventive Maintenance for TB Laboratory Equipment			
EQUIPMENT	PROCEDURE	FREQUENCY	RESPONSIBLE PERSON
pH METER	Checking volume of electrode storage solution	Biweekly	Assigned responsible laboratory personnel
	Cleaning external surfaces and performing a physical inspection	Monthly	Assigned responsible laboratory personnel
	Cleaning the electrode	Biannual	Assigned responsible laboratory personnel
	Reading time control	Daily	Equipment User

Checking volume of electrode storage solution

1. Check if the tip of the electrode is immersed in the storage solution.
2. If there is not enough solution, refill it. Recipient should never be left empty in order to prevent any damage to the electrode.
3. Fill the detector electrode with a saturated potassium chloride (KCl) solution, using the syringe or applicator supplied with the KCl solution. The filling will be carried out through the conduct protecting the upper cover of the electrode. Verify that the tip of the syringe does not touch the inside of the electrode. Check the storage solution with manufacturer's instructions.
4. While not in use, keep electrode in storage buffer solution.



FILLING THE DETECTOR ELECTRODE

Cleaning external surfaces and performing a physical inspection.

1. To prevent corrosion, all equipment parts should be cleaned using 70% ethanol.
2. Verify the state of the electrode arm. Examine the electrode attachment and assembly mechanism in order to prevent the electrode from becoming loose. Check that the height adjustment works properly.
3. Examine the exterior of the pH meter and evaluate its general physical condition. Verify the cleanliness of the covers and their adjustments.
4. Record the procedure in the Laboratory's Maintenance and Cleaning log book.



INTERNAL AND EXTERNAL CLEANING OF THE PH METER

Cleaning the electrode

1. Never scrub the membrane of the electrode with a cloth; simply rinse it with distilled water.
2. Remove grease films from the membrane of the electrode by using cotton balls soaked in acetone or another detergent solution.
3. Then, rinse with distilled water.
4. Test its function by measuring the pH of a known solution.
5. Record the procedure in the Laboratory's Maintenance and Cleaning log book.

Reading time control

1. With each use, record reading time.
2. Record any observation or equipment failure.

LIGHT MICROSCOPE/ FLUORESCENCE MICROSCOPE

In Tuberculosis Laboratories, microscopes are used for observing acid-fast bacilli in sputum smears. Two types of microscopes are used for TB diagnosis: brightfield optical microscope or fluorescence microscope.

User's Basic Preventive Maintenance for TB Laboratory Equipment			
EQUIPMENT	PROCEDURE	FREQUENCY	RESPONSIBLE PERSON
MICROSCOPE	Cleaning the objective lens	Daily	Equipment user
	Cleaning the mechanical and optical system	Monthly	Assigned responsible laboratory personnel



**FLUORESCENCE
MICROSCOPE**



**OPTICAL
MICROSCOPE**

Clean the objective lens.

1. Remove oil residues before each use.
2. The lens is considered to be in good operating condition when image can be perceived clearly through it. In the case of immersion lenses, there should be no residues of immersion oil (or similar) left on the objective or its lens.
3. Record the procedure in the Laboratory's Maintenance and Cleaning log book.



CLEANING THE OPTICAL MICROSCOPE LENSES AND EYEPIECES

Cleaning the mechanical and optical system.

1. Use a soft cloth to remove dirt from cables and control panel.
2. Use a rubber bulb to remove dust particles from lenses, objectives and condenser.
3. Do not use organic solvents (such as ethanol, ether, or thinners) to clean coated, plastic, or printed components.
4. Eyepieces are considered to be in good operating condition if image can be seen clearly through them and there are no dust particles present (or similar). In the presence of scratches that interfere with the field of vision, it is recommended to replace the eyepiece/s.
5. The stage is considered to be in good operating condition when it can move gently and uninterruptedly in all directions (X-Y) and its adjustment mechanism remains stable regarding the body of the instrument.
6. The slide holder is considered to be in good operating condition if the slide is held firmly in place.
7. The light intensity control rheostat is considered to be in good operating condition if light intensity changes when adjusting the rheostat.
8. Record the procedure in the Laboratory's Maintenance and Cleaning log book.

PIPETTES

Pipettes are devices used for measuring or transferring small volumes of liquid with great precision. Pipettes are widely used in most Tuberculosis laboratory tests and their functionality is very important. There should be a specific log book for recording equipment failure events and the calibration of pipettes.

User's Basic Preventive Maintenance for TB Laboratory Equipment			
EQUIPMENT	PROCEDURE	FREQUENCY	RESPONSIBLE PERSON
PIPETTES	Inspecting integrity and adjustment of mechanisms	Daily	Equipment User
	Leakage control and cleaning external surfaces	Daily	Equipment User
	Disassembling and cleaning all pipette parts	Bimonthly	Assigned responsible laboratory personnel

**AUTOMATIC
PIPETTE**



**MULTICHANNEL
PIPETTE**

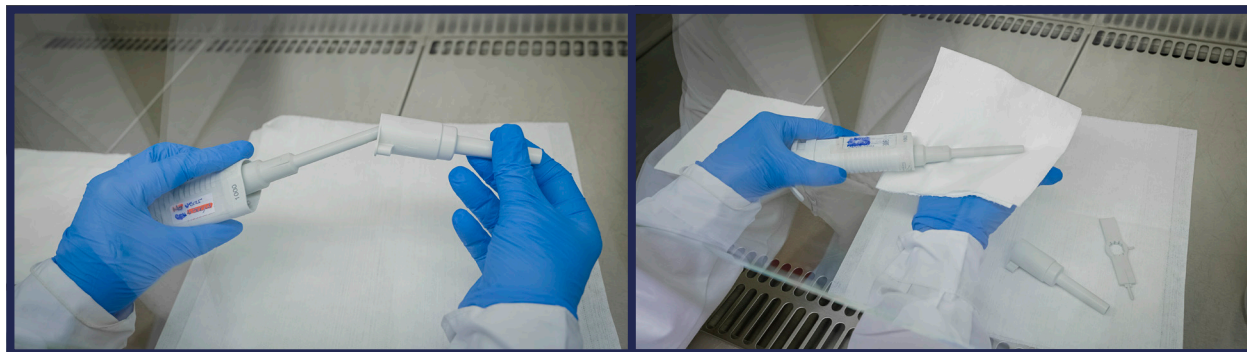


Inspecting integrity and adjustment of mechanisms

- Before each use, user should inspect all parts of the pipette and refrain from using it if there is any visible defect.

Leakage control and cleaning external surfaces

- Perform a leak test before its routine use. For this, put on a pipette tip and test it with distilled water.
- Clean pipette externally using a cloth and 70% ethanol before and after each use.



DISASSEMBLING AND CLEANING ALL PIPETTE PARTS

Disassembling and cleaning all pipette parts

1. It is recommended to disassemble and clean all parts of the pipette inside a certified Biological Safety Cabinet.
2. Depending on make and model, the parts of the pipette may be autoclavable: parts may be disassembled, properly labelled and placed inside an autoclave bag for their decontamination.

THERMAL CYCLER

The thermal cycler is used for amplifying DNA obtained from samples or isolates. All maintenance procedures, except for servicing, can be performed by responsible laboratory personnel under the supervision of the Equipment Officer.

User's Basic Preventive Maintenance for TB Laboratory Equipment			
EQUIPMENT	PROCEDURE	FREQUENCY	RESPONSIBLE PERSON
THERMAL CYCLER	Cleaning interior and exterior surfaces	Weekly	Assigned responsible laboratory personnel
	Verifying operation parameters	Daily	Equipment User



THERMAL CYCLER

Cleaning interior and exterior surfaces

1. In order to prevent corrosion, all equipment surfaces should be cleaned regularly, using a lint-free cloth dampened with 70% ethanol or a pH-neutral detergent solution.
2. Clean wells (after verifying they are not hot), using cotton swabs or cotton balls dampened with isopropyl alcohol / isopropanol.
3. Clean the lid using a lint-free cloth dampened with 70% ethanol.
4. Perform a visual examination of the thermal cycler exterior to evaluate its general physical condition.
5. Record the procedure in the Laboratory's Maintenance and Cleaning log book.



Verifying operation parameters

1. Verify that temperature parameters are as required.
2. Using the thermal cycler log book, record the values of each run or the program number, and any equipment failure or observation.

BACTEC MGIT

The BACTEC MGIT 960 TB system is an automated system for growing *Mycobacterium tuberculosis* in liquid medium (Modified Middlebrook 7H9 Broth) using *Mycobacteria* Growth Indicator Tubes (MGIT). This instrument ensures a better recovery and a faster detection of mycobacteria growth.

User's Basic Preventive Maintenance for TB Laboratory Equipment			
EQUIPMENT	PROCEDURE	FREQUENCY	RESPONSIBLE PERSON
BACTEC MGIT	Cleaning exterior surfaces	Weekly	Assigned responsible laboratory personnel
	Verifying operation parameters	Daily	Equipment User
	Cleaning the air filter	Monthly	Assigned responsible laboratory personnel

Cleaning exterior surfaces

1. In order to prevent corrosion, all equipment surfaces should be cleaned regularly, using a lint-free cloth dampened with 70% ethanol or a pH-neutral detergent solution.
2. Record the procedure in the Laboratory's Maintenance and Cleaning log book.



**EXTERNAL CLEANING
OF THE BACTEC-MGIT**

Cleaning the air filter

The maintenance of the air filter of the BACTEC MGIT equipment must be carried out monthly, as described:

1. Remove the faceplate by holding it by the bottom edge in the finger holes. Gently, but firmly, pull out.
2. Remove the filter and wash with water.
3. Dry well with paper towels and replace in the equipment.
4. The cutout in the faceplate should surround the on / off switch. Press firmly towards the computer. The faceplate will snap into place.
5. Record the cleaning on the Laboratory Equipment Cleaning and Maintenance Record Sheet.

Every day, before loading or unloading tubes in the BACTEC MGIT equipment, a check of all the functions and key devices of the equipment should be carried out: the external lamp indicator, the drawer indicator lamp and the internal thermometers. The temperature values, observations or faults must be recorded in the Equipment Use Record Sheet.

Verifying operation parameters

1. Verify that temperature parameters are as required.
2. Check that the external lamps on all drawers and that the LEDs at all the stations work properly.
3. Record temperature values and any observation or equipment failure in the system's daily log book.

Check the expiration date of the calibrators in each drawer; if they have expired, they can be changed by responsible laboratory personnel.



**VERIFICATION
OF STATION LEDs**

GENEXPERT

The GeneXpert system is a fully integrated and automated system used for the diagnosis of Tuberculosis and the detection of resistance to rifampicin or isoniazid, aminoglycosides and quinolones (depending on what cartridge is being used) through a nucleic acid amplification test.

All maintenance procedures can be performed by the responsible laboratory technician under the supervision of the Equipment Officer.

User's Basic Preventive Maintenance for TB Laboratory Equipment			
EQUIPMENT	PROCEDURE	FREQUENCY	RESPONSIBLE PERSON
GENEXPERT	Discarding used cartridges	Daily	Equipment User
	Cleaning the cartridge bay interior	Weekly	Assigned responsible laboratory personnel
	Cleaning the syringe plunger rod	Monthly	Assigned responsible laboratory personnel
	Cleaning instrument surfaces	Monthly	Assigned responsible laboratory personnel
	Cleaning optics inside PCR tube	Monthly	Assigned responsible laboratory personnel
	Cleaning fan filters	Monthly	Assigned responsible laboratory personnel

Cleaning process

1. Clean all equipment parts using a lint-free cloth dampened with a mild detergent, let dry and then clean using 70% ethanol.
2. Clean the optics inside the PCR tube using a dry brush.
3. Record the procedure in the Laboratory's Maintenance and Cleaning log book.

Cleaning the cartridge bay interior

1. Dampen a lint-free cloth with a 10% sodium hypochlorite solution.
2. Wipe the cartridge bay, and the inside and borders of the door.
3. Wait 2 minutes.
4. Repeat steps 1 to 3 three times.
5. Dampen a lint-free cloth with 70% ethanol.
6. Wipe the aforementioned surfaces with the ethanol solution.

NOTE The lint-free cloth should be changed frequently during the cleaning procedure. Follow laboratory's instructions to discard used clothes.



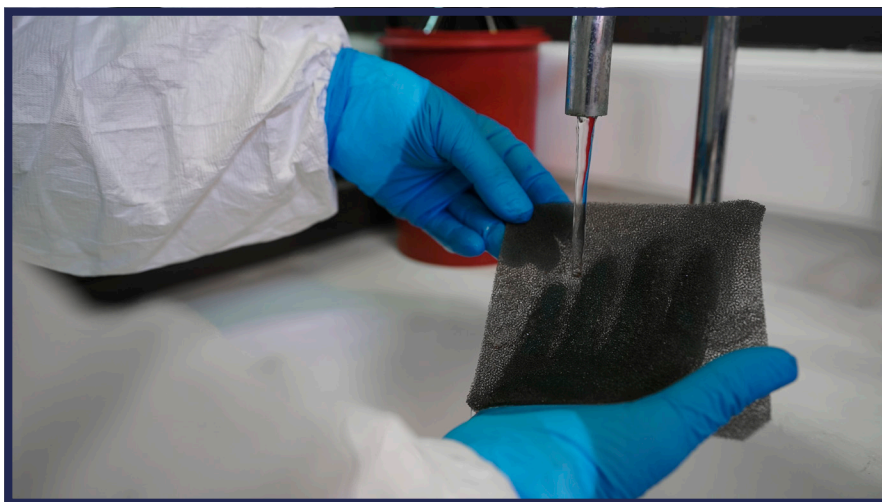
INTERNAL CLEANING OF THE GENEXPERT

Plunger maintenance

1. Access the Menu Bar and then select Maintenance -> Plunger Maintenance
2. In the Plunger Maintenance window, choose the option "Clean All"
3. Follow the instructions detailed in the dialog window and click "OK"
4. The plunger rod in the selected module will lower into the cartridge bay
5. Wipe gently to remove the black debris on the plunger rod.
6. Once the plunger has been cleaned, select the option "Move Up All"
7. The plunger will move back up to its original position
8. Click "Close"

Cleaning fan filters (located on the outside of the instrument back cover)

1. Unscrew the four screws, one by one
2. Remove the filter (sponge)
3. Wash the filter using soap and water
4. Dry between 2 paper towels (filter should be completely dry before putting it back in)
5. Replace filter if necessary (available upon request)



CLEANING THE FAN FILTER

GT-BLOT (FOR LPA)

The GT-Blot is one of the instruments used for the line probe assay. All maintenance procedures can be performed by the responsible laboratory technician under the supervision of the Equipment Officer.

User's Basic Preventive Maintenance for TB Laboratory Equipment			
EQUIPMENT	PROCEDURE	FREQUENCY	RESPONSIBLE PERSON
GT – BLOT	Cleaning the GT-Blot trays	Daily	Equipment user
	Cleaning the insert for the internal tray and the exterior surfaces	Weekly	Assigned responsible laboratory personnel

Cleaning the GT-Blot trays

1. Soak trays thoroughly using a diluted bleach solution.
2. Remove excess liquid and then spray with 70% ethanol and wipe the wells thoroughly in order to remove any residue (using a cotton-tipped applicator stick).
3. After cleaning, wash thoroughly using distilled water to ensure all bleach is removed. Any remaining bleach residue may affect the color of the strips
4. Discard the water and wash a second time using distilled water.
5. Dab remaining liquid on a fresh paper towel and leave to air dry.
6. Once dry, the tray can be reused.
7. Keep several trays available, so that they can be alternated. Trays can be reused for quite some time, but, during the cleaning process, check for holes at the bottom of the black trays.
8. If a hole is detected, the tray should be discarded.
9. Record the procedure in the Laboratory's Maintenance and Cleaning log book.

Cleaning the exterior of the GT Blot 48

1. Clean the outside of the instrument using a wet lint-free cloth. Turn off the instrument and close the lid before the cleaning process.
2. On a weekly basis, carefully clean the insert for the tray inside the instrument, using 70% ethanol and a cotton-tipped applicator stick to remove any residues between the plates. Do not use bleach inside the instrument.
3. Record the procedure in the Laboratory's Maintenance and Cleaning log book.

TWINCUBATOR (FOR LPA)

The TwinCubator is used for DNA hybridization in the line probe assay. All maintenance procedures, except for servicing, can be performed by responsible laboratory personnel under the supervision of the Equipment Officer.

User's Basic Preventive Maintenance for TB Laboratory Equipment			
EQUIPMENT	PROCEDURE	FREQUENCY	RESPONSIBLE PERSON
TWINCUBATOR	Routine cleaning	Daily	Equipment user
	Thorough cleaning	Weekly	Assigned responsible laboratory personnel



TWINCUBATOR

Routine cleaning

1. Before each use, clean and decontaminate using 70% ethanol.
2. To prevent condensation, clean the lid during its operation. All equipment parts should be cleaned using a lint-free cloth dampened with 70% ethanol or with a pH-neutral detergent solution.
3. Record the procedure in the Laboratory's Maintenance and Cleaning log book.

Thorough cleaning

1. Clean using a solution of 1% bleach and rinse with water, so there are no residues left.
2. Clean the unit's frame and all equipment parts using 70% ethanol.
3. Record temperature values and any observation or equipment failure in the equipment daily log book.



TWINCUBATOR CLEANING

User's Basic Preventive Maintenance for TB Laboratory Equipment Summary

User's Basic Preventive Maintenance for TB Laboratory Equipment			
EQUIPMENT	PROCEDURE	FREQUENCY	RESPONSIBLE PERSON
ALL AUTOCLAVES	Cleaning internal chamber	Daily	Assigned responsible laboratory personnel
PASS-THROUGH AUTOCLAVE	Cleaning and checking the filter on the bottom of the chamber	Biweekly	Assigned responsible laboratory personnel
PASS-THROUGH AUTOCLAVE	Cleaning and lubricating door's gasket	Weekly	Assigned responsible laboratory personnel
PASS-THROUGH AUTOCLAVE	Purging (draining) the vapor generator	Weekly	Assigned responsible laboratory personnel
PASS-THROUGH AUTOCLAVE	Verifying the compressed-air pressure regulator of pneumatic valves	Bimonthly	Assigned responsible laboratory personnel
BALANCES	Cleaning plates and external surfaces	Weekly	Assigned responsible laboratory personnel
	Verifying that balance is levelled	Monthly	Assigned responsible laboratory personnel
	Verifying the zero setting	Monthly	Assigned responsible laboratory personnel
WATER-BATH	Cleaning interior and exterior surfaces	Monthly	Assigned responsible laboratory personnel
	Lubrication	Daily	Assigned responsible laboratory personnel
	Recording temperature and water level	Daily	Equipment User
HEAT BLOCK	Cleaning interior and exterior surfaces	Monthly	Assigned responsible laboratory personnel
	Recording temperature and time	Daily	Equipment User
BIOLOGICAL SAFETY CABINET	Cleaning interior surfaces	Daily	Equipment User
	Verifying operation parameters	Daily	Equipment User
	Cleaning exterior surfaces and internal parts	Monthly	Assigned responsible laboratory personnel
	Air sampling on agar plates	Biannually	Assigned responsible laboratory personnel
	Visual examination of airflow	Monthly	Assigned responsible laboratory personnel

User's Basic Preventive Maintenance for TB Laboratory Equipment Summary

User's Basic Preventive Maintenance for TB Laboratory Equipment			
EQUIPMENT	PROCEDURE	FREQUENCY	RESPONSIBLE PERSON
CENTRIFUGE	Cleaning rotor compartment and centrifuge surfaces	Daily	Equipment User
	Cleaning external surface and dismounting centrifuge parts	Weekly	Assigned responsible laboratory personnel
	Verifying centrifuge locking mechanism	Daily	Equipment User
	Verifying state of rubber rings (<i>O-rings</i>) (<i>For rotors with safety mechanisms</i>)	Daily	Assigned responsible laboratory personnel
	Recording temperature (<i>for refrigerated centrifuges.</i>)	Daily	Equipment User
INSPISSATOR	Cleaning interior and exterior surfaces	Monthly	Assigned responsible laboratory personnel
	Verifying water level. (<i>In case it has any to create humidity</i>)	Daily	Equipment User
	Temperature control	Daily	Equipment User
WATER DISTILLER	Cleaning interior and exterior surfaces	Monthly	Assigned responsible laboratory personnel
	Cleaning storage tank	Monthly	Assigned responsible laboratory personnel
FREEZER/ REFRIGERATOR	Cleaning interior and exterior surfaces	Monthly	Assigned responsible laboratory personnel
	Verifying that door gasket and hinges are functional	Monthly	Assigned responsible laboratory personnel
	Cleaning filters	Monthly	Assigned responsible laboratory personnel
	Defrosting	Biannual	Assigned responsible laboratory personnel
	Temperature control	Daily	Equipment User
DRYING OVEN	Cleaning interior and exterior surfaces	Biweekly	Assigned responsible laboratory personnel
	Thorough cleaning	Quarterly	Assigned responsible laboratory personnel
	Temperature control	Daily	Equipment User

User's Basic Preventive Maintenance for TB Laboratory Equipment Summary

User's Basic Preventive Maintenance for TB Laboratory Equipment			
EQUIPMENT	PROCEDURE	FREQUENCY	RESPONSIBLE PERSON
INCUBATOR	Cleaning interior and exterior surfaces	Monthly	Assigned responsible laboratory personnel
	Thorough cleaning	Annual	Assigned responsible laboratory personnel
	Controlling temperature and incubator's integrity	Daily	Equipment User
pH METER	Checking volume of electrode storage solution	Biweekly	Assigned responsible laboratory personnel
	Cleaning external surfaces and performing a physical inspection	Monthly	Assigned responsible laboratory personnel
	Cleaning the electrode	Biannual	Assigned responsible laboratory personnel
	Reading time control	Daily	Equipment User
MICROSCOPE	Cleaning the objective lens	Daily	Equipment user
	Cleaning the mechanical and optical system	Monthly	Assigned responsible laboratory personnel
PIPETTES	Inspecting integrity and adjustment of mechanisms	Daily	Equipment User
	Leakage control and cleaning external surfaces	Daily	Equipment User
	Disassembling and cleaning all pipette parts	Bimonthly	Assigned responsible laboratory personnel
THERMAL CYCLER	Cleaning interior and exterior surfaces	Weekly	Assigned responsible laboratory personnel
	Verifying operation parameters	Daily	Equipment User
BACTEC MGIT	Cleaning exterior surfaces	Weekly	Assigned responsible laboratory personnel
	Verifying operation parameters	Daily	Equipment User
	Cleaning the air filter	Monthly	Assigned responsible laboratory personnel

User's Basic Preventive Maintenance for TB Laboratory Equipment Summary

User's Basic Preventive Maintenance for TB Laboratory Equipment			
EQUIPMENT	PROCEDURE	FREQUENCY	RESPONSIBLE PERSON
GENEXPERT	Discarding used cartridges	Daily	Equipment User
	Cleaning the cartridge bay interior	Weekly	Assigned responsible laboratory personnel
	Cleaning the syringe plunger rod	Monthly	Assigned responsible laboratory personnel
	Cleaning instrument surfaces	Monthly	Assigned responsible laboratory personnel
	Cleaning optics inside PCR tube	Monthly	Assigned responsible laboratory personnel
	Cleaning fan filters	Monthly	Assigned responsible laboratory personnel
GT – BLOT	Cleaning the GT-Blot trays	Daily	Equipment user
	Cleaning the insert for the internal tray and the exterior surfaces	Weekly	Assigned responsible laboratory personnel
TWINCUBATOR	Routine cleaning	Daily	Equipment user
	Thorough cleaning	Weekly	Assigned responsible laboratory personnel

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