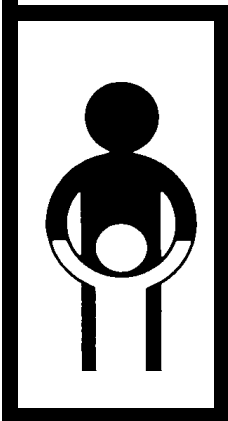


# Module 4:

# Ensuring safe injections



**GLOBAL PROGRAMME FOR VACCINES AND IMMUNIZATION**

**EXPANDED PROGRAMME ON IMMUNIZATION**



*World Health Organization, Geneva, 1998*

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# About this module

An injection should be given only if necessary, and every injection must be safe. An injection is safe:

- for the *client*, when a sterile syringe and a sterile needle and appropriate injection techniques are used;
- for the *health worker*, when he or she avoids needle-stick injuries;
- for the *community*, when used injection equipment is disposed of correctly.

This module describes how to ensure safe injections, and the equipment you need and the procedures you must follow in cleaning, sterilizing, handling and disposing of injection equipment.

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# 1. Injection equipment

## 1.1 Types of injection equipment

The following equipment can be used to administer injectable vaccines:

- single-use syringes and needles;
- sterilizable syringes and needles;
- prefilled syringes.

### *Single-use syringes and needles*

Single-use syringes and needles are appropriate for all types of immunization strategies, including use in fixed clinics and in outreach and special campaigns. They are recommended for use where sterilization of reusable injection equipment cannot be guaranteed. A sterile packed syringe and a sterile packed needle must be used for each injection and they must be destroyed immediately after use. There are two types of single-use syringes and needles: **standard disposable** and **autodestruct**.

Standard disposable syringes and needles can be used for immunization only in settings where it is guaranteed that they will be destroyed after a single use, as verified by monitoring of consumption and supervision of disposal. Their reuse places the general public at high risk of disease and death.

Autodestruct syringes are designed so that it is **impossible** to use them more than once. Consequently they present the lowest risk of person-to-person transmission of blood-borne pathogens. They are the preferred type of disposable equipment for administering vaccines, particularly in mass immunization programmes.

Single-use syringes and needles should be used **only** where they can be safely disposed of after use.

### *Sterilizable syringes and needles*

Sterilizable syringes can be used in routine immunization sessions where compliance with cleaning and sterilization procedures between each use can be assured, as verified by supervisory visits and routine use of time, steam and temperature monitors. They are neither practical nor economical for mass immunization sessions and should not be used for this purpose. A sterile syringe and a sterile needle must be used for each injection.

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A reusable syringe lasts for 50 to 200 sterilizations, depending on the hardness of the water used. Reusable needles have an average life span of 50 sterilizations.

Reusable equipment is most appropriate for use in fixed immunization clinics in which 30 to 120 injections are given in a day.

Immediately after use the syringes and needles must be flushed with clean water, soaked in clean water, and carefully cleaned by the end of the session. Then they must be steam sterilized for 20 minutes at a temperature between 121° C and 126° C.

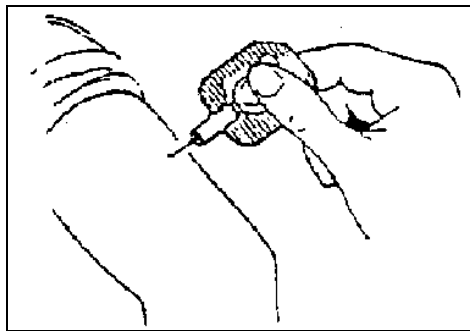
**Reusable syringes and needles should be used only if their sterility can be guaranteed. This means that you must have the appropriate sterilization equipment in good working condition and that it must be correctly used.**

### *Prefilled syringes*

Prefilled syringes are single-dose packets of vaccine to which a needle has been fixed by the manufacturer. This type of injection equipment can be used only once.

Every prefilled syringe and needle is sterilized and sealed in its own foil package by the manufacturer. Just before an injection, the health worker removes the foil and the cap that covers the needle. After the injection, the used syringe and needle must be disposed of safely.

**Figure 4-A: Prefilled syringe**



The first EPI vaccines to be available in prefilled syringes will probably be hepatitis B vaccine and tetanus toxoid.

## 1.2 Sizes of syringes and needles

Different sizes of syringes and needles are needed for different uses.

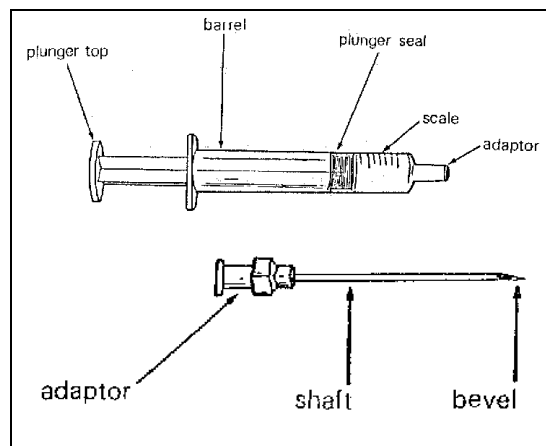
Use	Syringe size	Needle size
BCG (for intradermal injections)	0.1 ml	<b>Reusable</b> 10 mm, 26 gauge  <b>Single-use</b> 10 mm, 27 or 28 gauge
All other EPI vaccines (for intramuscular or subcutaneous injections)	1.0 ml	<b>Reusable</b> 25 mm, 22 gauge  <b>Single-use</b> 25 mm, 23 gauge
Reconstitution	5.0 ml	76 mm, 18 gauge

## 1.3 Parts

### of a syringe and needle

Reusable and disposable syringes and needles have the same parts. It is important to know what these parts are called in order to handle the equipment safely.

**Figure 4-B - Parts of a needle and syringe**



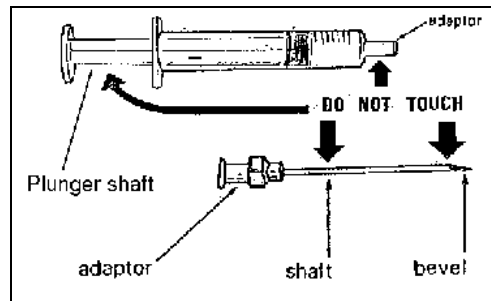
## 1.4 Handling syringes and needles safely

You have to hold a syringe to give an injection. Because any part of the syringe that you touch becomes contaminated, you should not touch parts that come into contact with the vaccine you are injecting or with the patient.

**Do not touch:**

- the shaft of the needle;
- the bevel of the needle;
- the adaptor of the needle;
- the adaptor of the syringe;
- the plunger seal of the syringe;
- the plunger shaft of the syringe.

**Figure 4-C: Parts of a syringe and needle which must not be touched**

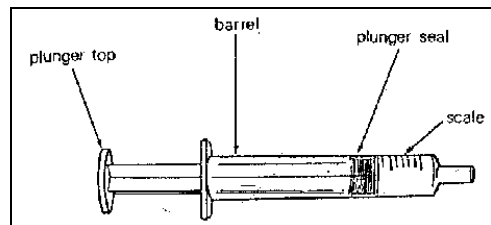


If you touch any of these parts by accident, discard the syringe and needle and get new sterile ones.

**You may touch:**

- the barrel;
- the plunger top.

**Figure 4-D: parts of a syringe and needle which may be touched**



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## 2. Soaking, cleaning and sterilizing reusable syringes and needles

When injection equipment is sterilized, all microorganisms and spores on it are killed. If unsterile syringes and needles are used they can cause infections.

Whereas **single-use** syringes and needles are packed and sterilized by their manufacturers, **reusable** ones are not and must be sterilized before they are first used and after every use.

When reusable injection equipment is used, touched, put on an unsterile surface, or exposed to contamination in any other way, it must be flushed, soaked, cleaned and sterilized. To do this safely, you must have the right equipment and follow procedures carefully.

### 2.1 Equipment

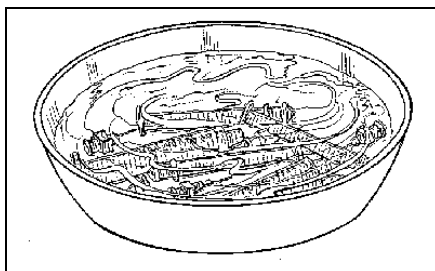
The equipment you need for flushing, soaking, cleaning and sterilizing injection equipment includes:

- a washbasin;
- forceps;
- a steam sterilizer;
- a time, steam and temperature (TST) indicator;
- a hard water pad;
- a timer;
- a stove, fuel and matches.

#### *Washbasin*

This is a plastic container for soaking syringes and needles immediately after use and for cleaning them before sterilization.

**Figure 4-E: Washbasin with needles and syringes soaking**



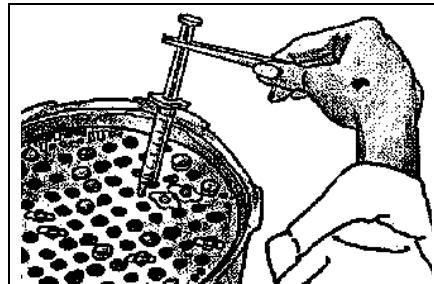
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### *Forceps*

Forceps are needed for lifting syringes, needles and other equipment from washbasins and steam sterilizers and for assembling syringes and needles after sterilization.

You need two sterilized forceps so that if one is contaminated you still have one that is sterilized.

**Figure 4-F: Forceps in use**



### *Steam sterilizer*

This is a portable lightweight sterilizer similar to a domestic pressure cooker but specifically designed for immunization programmes.

Steam sterilizers are available in three sizes:

*single rack* - holds 40 to 42 syringes and 50 needles of all sizes;

*double rack* - holds twice as many syringes and needles as a single rack;

*triple rack* - holds three times more than a single rack.

**Figure 4-G: Single- and double-rack sterilizers**



*Sterilizer drums* are sometimes used instead of racks. After sterilization the drums can be sealed so that the drums and their sterile contents can be carried to immunization sessions without the sterilizer.

**Figure 4-H: Sterilizer drum**

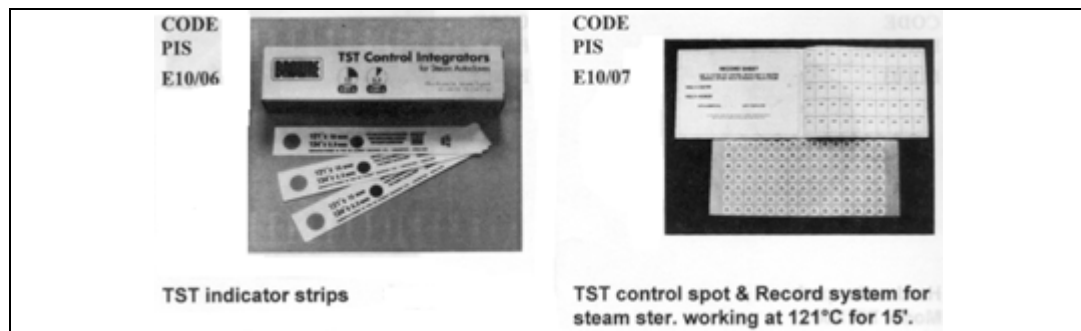


***Time, steam and temperature (TST) indicator***

This device is placed in a sterilizer and changes colour when the contents have been sterilized.

TST indicators are in the form of paper strips or dots.

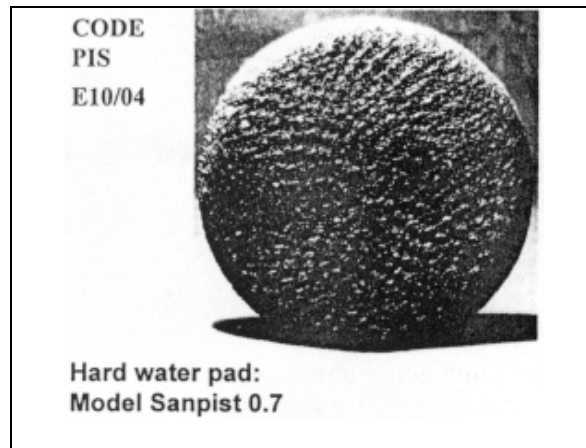
**Figure 4-I: Strip and control dots**



***Hard water pad***

This is a wire mesh pad that can be put in a sterilizer to soften the water. Soft water extends the life of reusable syringes and needles.

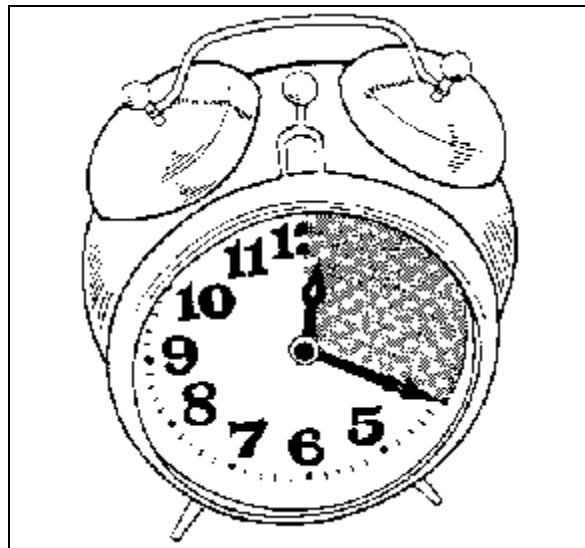
**Figure 4-J: Hard water pad**



*Timer*

A timer is used to ensure that the correct time (20 minutes) is allowed for sterilization.

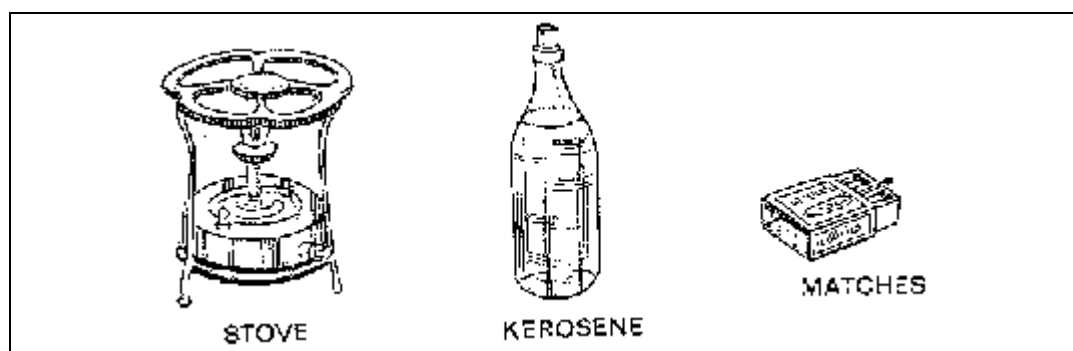
**Figure 4-K: Timer**



*Stove, fuel and matches*

A steam sterilizer can be heated with a kerosene stove, gas burner, electric heating element, wood stove or charcoal stove.

**Figure 4-L: Kerosene stove**



## **2.2 Procedures for flushing, soaking and cleaning reusable syringes and needles**

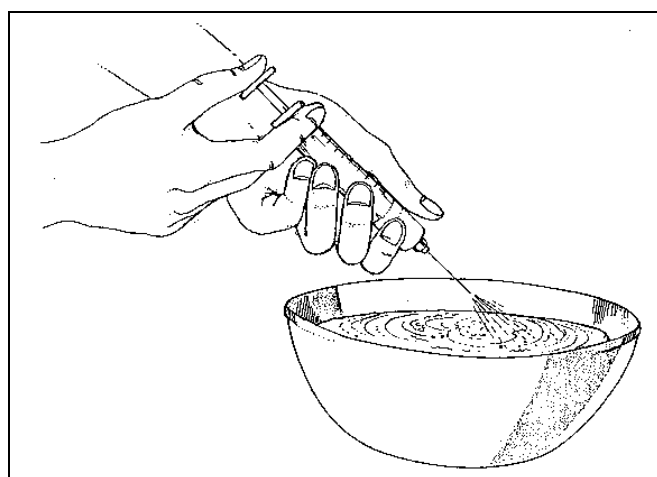
Before sterilizing reusable syringes and needles, you must flush, soak and clean them and make sure they are working properly.

You need a washbasin that you use only for this purpose. You also need forceps with which to manipulate the syringes and needles, and clean cold water. Do not use soap or disinfectant for soaking or cleaning.

### ***Flush the syringes and needles immediately***

- Immediately after use, flush needles and syringes with cold water. This prevents the needles from becoming blocked.

**Figure 4-M: Flushing a syringe and needle with water**



### ***Soak the syringes and needles***

- Put the syringe and needle in the washbasin without taking them apart. Soaking used syringes and needles in cold water makes them easier to clean.

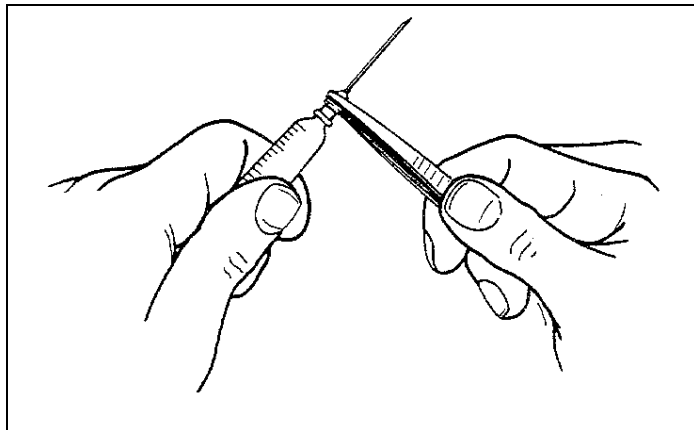
- 
- To prevent needle-stick injuries, lay the syringes side-by-side in the washbasin, with all the needles pointing in the same direction.
  - If you are planning to sterilize syringes and needles within two hours after use you do not have to soak them before cleaning.

### ***Clean the syringes***

Cleaning removes most microorganisms and contamination.

- Just before sterilizing, pour away the water in which the syringes and needles have been soaking and refill the washbasin with clean water.
- Before taking the syringe apart, make sure that the plunger seal fits inside the barrel properly. It should be tight but not so tight that it cannot move.
- Using forceps, separate the needle from the syringe. Leave the needle in the washbasin until you are ready to clean it.

**Figure 4-N: Separating needle and syringe with forceps**



- Flush the syringe with the water in the washbasin.
- Take the plunger out of the barrel and rinse both in the washbasin.
- Check the parts of the syringe as described in Section 5) below.

### ***Clean the needles***

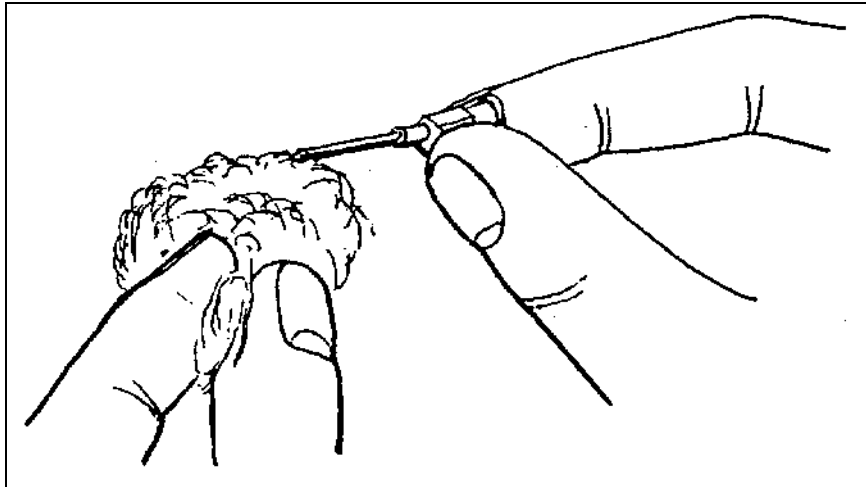
- Take a clean 5 ml syringe, attach a needle from the washbasin and flush clean water in and out of the needle several times.
- If water does not go through the needle, it is blocked. Put it in a puncture-proof container and dispose of it properly (see below).

### ***Make sure that the syringes and needles are working properly***

Check the syringes and needles before loading them into the sterilizer.

- Make sure that you can read the scale on each syringe.
- Test each needle for barbs by drawing it carefully across some cotton wool or gauze. If the needle is barbed it will catch in the cotton wool or gauze.

**Figure 4-O: Testing for a barb**



- Put barbed needles in a puncture-proof container for disposal. An injection with a barbed needle is painful; it also damages tissues and causes infection.

**Never test a needle for barbs with your finger or on your skin.**

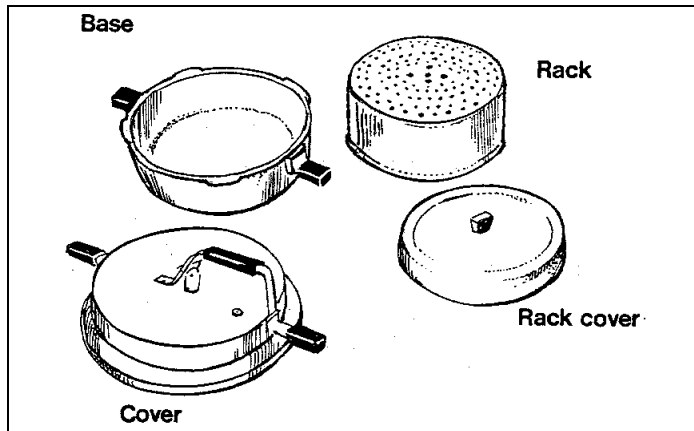
**Never give an injection with a barbed needle.**

### **2.3 Procedures for sterilizing injection equipment**

A steam sterilizer has four parts:

- the base;
- the lid, which fits on the base;
- the rack or drum, which holds syringes and needles ;
- the rack or drum lid, which fits on the rack or drum.

**Figure 4-P: Parts of a sterilizer, including drum**



**Note.** Steam sterilizers from different manufacturers differ slightly from one another. See the instructions that come with your sterilizer for specific information.

***Load the sterilizer***

Whether you use a drum or a rack, follow the steps below for loading.

- Put the barrels of the syringes in the largest holes in the rack or drum.

**Figure 4-Q: Putting barrels into the largest holes**



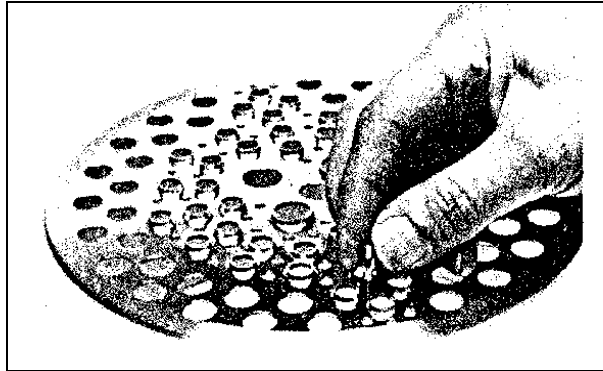
- Put the plungers into the medium-sized holes. The medium-sized holes have raised edges.

**Figure 4-R: Putting plungers into medium-sized holes**



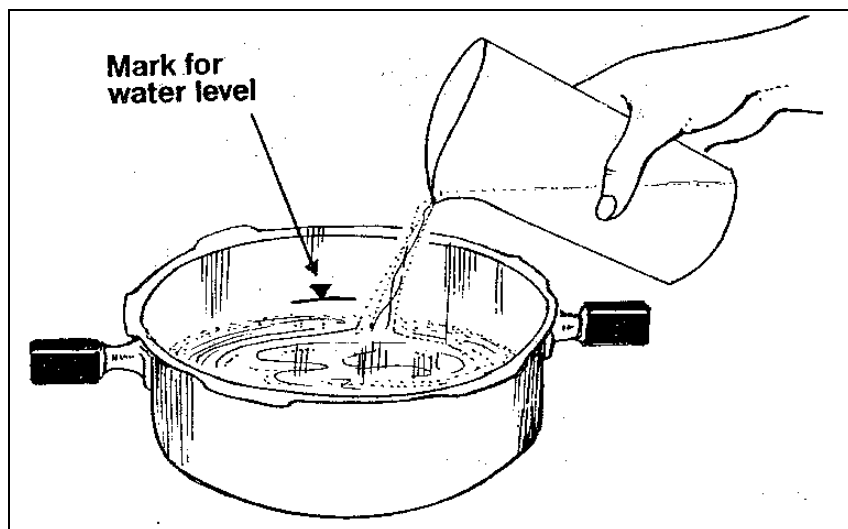
- **Put needles, points downwards, into the smallest holes:** Hold each needle in one hand at an angle and tip it into a hole. Do NOT put your fingers around the hole to guide the needle.

**Figure 4-S: Putting a needle into a small hole, showing the needle at an angle, not straight up and down**



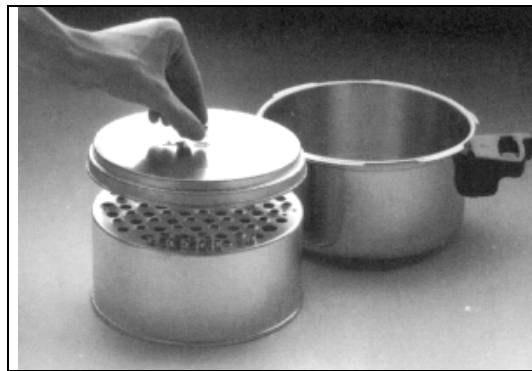
- Be careful not to jab the point of the needle against the rack or drum when you put the needle into the hole.  
To make assembly after sterilization easier, place:
  - BCG needles near BCG syringes;
  - DPT, measles and TT needles near 1 ml syringes;
  - mixing needles near 5 ml syringes.
- **Put water into the sterilizer base.** Fill water up to the mark on the inside of the base. If you are using a hard water pad, place it in the water.

**Figure 4-T: Putting water into the sterilizer base**



- 
- **Put a TST indicator on the rack or drum:** Put a TST indicator on top of the syringes and needles in the rack or drum.
  - **Put the rack or drum lid on the rack or drum:** If you are using a drum, make sure that the vents are open before putting the lid on. (After sterilization, when you remove the drum from the base, you close these vents.)
  - Squeeze the clip on the handle of the lid so that it fits into the hole in the rack or drum.

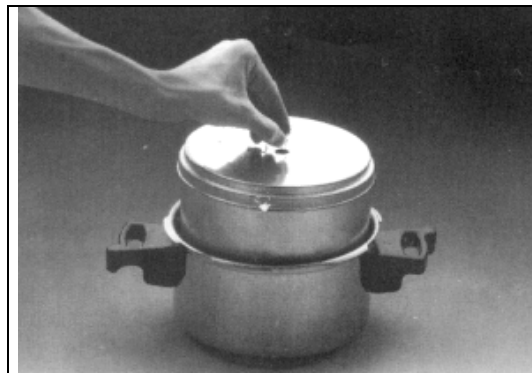
**Figure 4-U: Putting lid on rack**



**Note.** If you are using a double- or triple-rack sterilizer, put a lid on each rack.

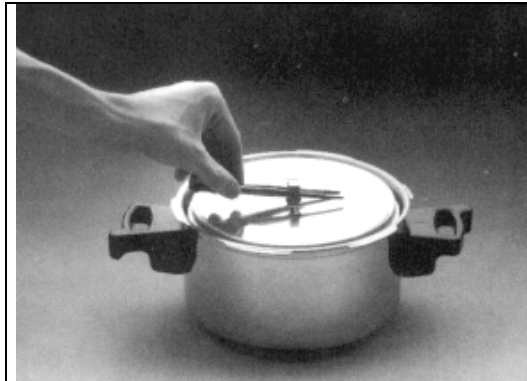
- **Put the rack or drum in the sterilizer base.**

**Figure 4-V: Putting the rack in the sterilizer base**



- **Put the forceps on the rack lid or inside the drum.**

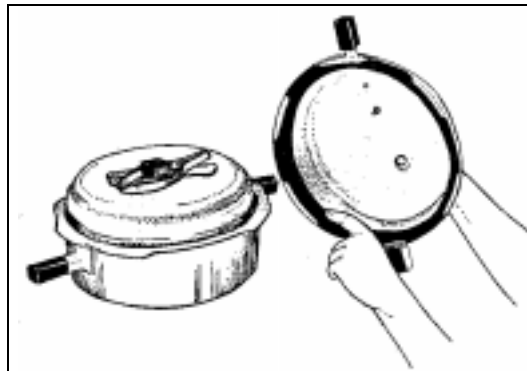
**Figure 4-W: Forceps on rack lid**



**Note.** If you are using a double- or triple-rack sterilizer, put forceps on the top rack lid only.

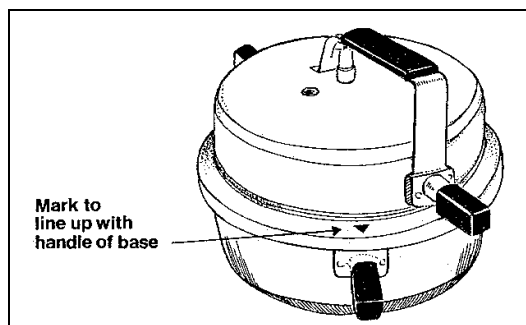
- **Check the rubber seal on the sterilizer lid:** Make sure that the rubber seal is in place and that it is in good condition.

**Figure 4-X: Checking the rubber seal on the sterilizer**



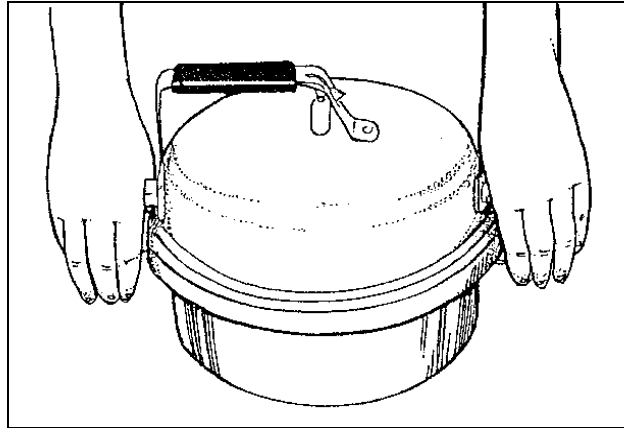
- **Put the sterilizer lid on the sterilizer base:** The V mark on the lid should line up with the handle on the base.

**Figure 4-Y: putting the lid on the sterilizer base**



- 
- **Secure the lid to the base:** Press down on the handles of the lid and turn it clockwise until it will not turn any more. The handles of the lid should now be on top of the handles of the base.

**Figure 4-Z: Cover in place**



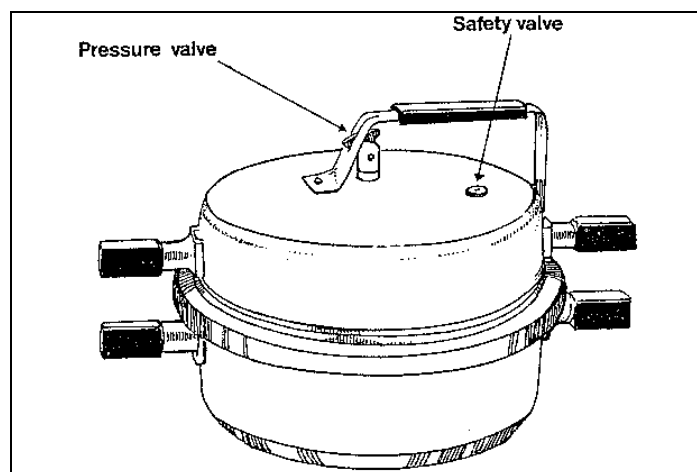
- **Check the valves on the sterilizer lid:** There are two valves on the sterilizer lid: the safety valve and the pressure valve. The **safety valve** is a small black circle of rubber with a metal pin in the middle. This valve opens if the water in the sterilizer boils away.

Make sure that the metal pin in the safety valve is down. The **pressure valve** controls the steam in the sterilizer. Make sure that the lever of the pressure valve is down.

**\*\*\*Figure 4-AA: Sterilizer with both valves up**



**\*\*\*Figure 4-BB: Sterilizer with both valves down and ready for sterilization**



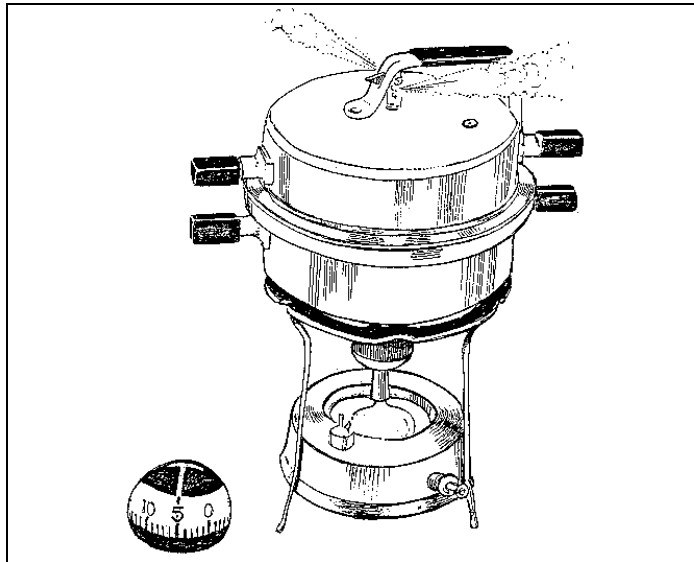
### *Sterilize*

The most efficient way to sterilize reusable injection equipment is to steam it at a temperature between 121°C and 126°C for 20 minutes, in accordance with the manufacturer's instructions. The combination of time, steam and temperature kills tetanus spores, bacteria that cause abscesses, and viruses such as hepatitis B virus and human immunodeficiency virus (HIV). A TST indicator must be included in each sterilization cycle. It should be inspected at the time of use and attached to the immunization report.

Although boiling achieves high-level disinfection it does not sterilize and therefore is not recommended.

- **Light the stove and put the sterilizer on it:** Make sure that the stove is on a firm surface and out of children's reach. Light the stove and put the burner on high or full. Place the sterilizer on the stove.
- **When steam comes from the pressure valve, set the timer for 20 minutes** Steam escapes from the pressure valve a few minutes after the burner has been turned to high. Set the timer for 20 minutes when this happens.

**Figure 4-CC: Steam coming out, timer set for 20**



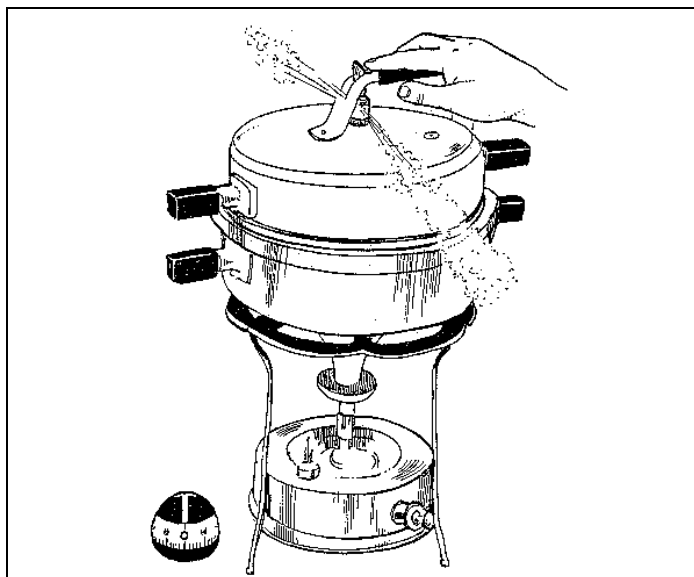
You may turn the burner down but not too low. You must be able to hear steam coming out of the pressure valve at all times.

- **When the timer rings, turn off the burner, open the pressure valve and remove the sterilizer from the stove:** After 20 minutes, when the timer rings, turn off the burner.

Open the pressure valve by lifting it up with forceps, a pencil, pen, spoon or other implement. Do NOT use your bare hands.

Steam escapes and makes a lot of noise. This is normal.

**Figure 4-DD: Lifting the pressure valve**



- 
- Remove the sterilizer from the stove. Wait at least one hour for the equipment inside the sterilizer to cool before you take the lid off.

**Use only cool syringes and needles to give injections. Warm ones can damage vaccine and cause pain to patients.**

How to open a sterilizer and assemble syringes and needles is described in Module 7.

**Sterilize equipment at the end of each immunization session.**

## **2.4 Problems with steam sterilizers**

- **If steam is coming from under the sterilizer lid**, check the position and quality of the rubber seal and adjust or replace it.
- **If steam is coming from the safety valve**, check the position of the safety valve and adjust or replace it.
- **If the syringes have melted** you may have used too little water or heated the sterilizer for too long, causing it to boil away. Use the correct amount of water and check your timing.

When you have problems with a sterilizer:

- turn off the heat;
- open the pressure valve;
- wait for the sterilizer to cool;
- identify the problem;
- correct the problem or use another sterilizer;
- inform your supervisor if necessary.

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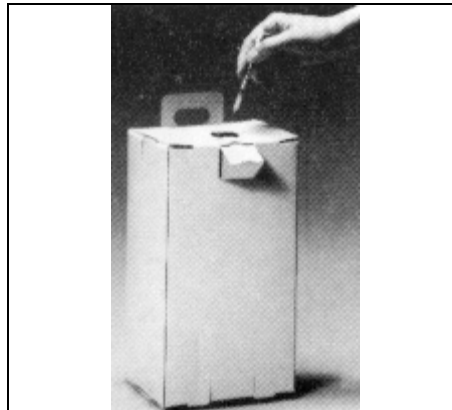
## 3. Disposing of syringes and needles

All syringes and needles must be safely disposed of when they can no longer be used. Single-use injection equipment is disposed of after one use, reusable injection equipment when it is worn out after many sterilizations or is no longer usable for other reasons.

### 3.1 Equipment

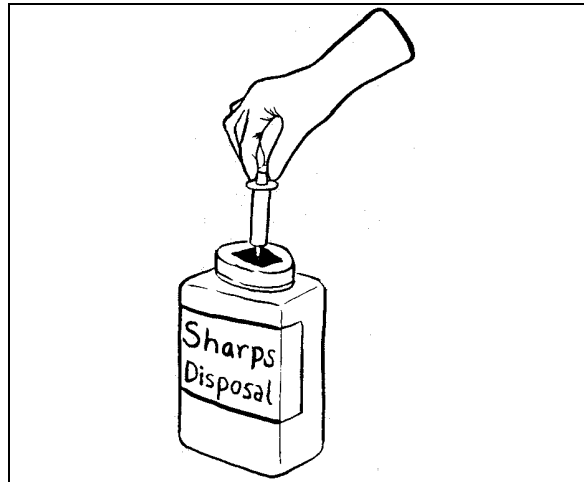
Before disposal, syringes and needles should be placed in a puncture-proof container. Special boxes for collection and destruction by burning may be purchased. These are waterproof and tamper-proof, and needles cannot pierce them.

**\*\*\*Figure 4-EE: Puncture-proof box**



Alternatively, you may use containers made of thick plastic, or metal cans, for collecting syringes and needles and transporting them to an incinerator or other site where they can be burned.

\*\*\*Figure 4-FF: Handmade disposal box



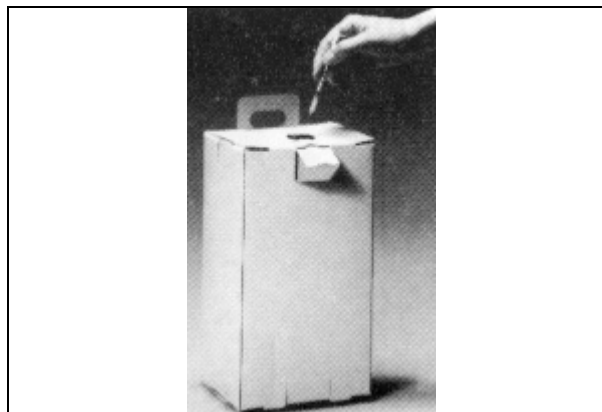
### 3.2 Procedures for disposing of injection equipment

All injection equipment is eventually disposed of. **Single-use** syringes and needles are used once and then destroyed. **Reusable** syringes and needles are destroyed when they become damaged.

Follow these steps to dispose of injection equipment safely:

- **Place syringes and needles in a disposal box**
  - **Single-use syringe and needle:** after a single use, place the used syringe and needle directly in a disposal box. To avoid needle-stick injuries, **do not attempt to recap the needle or to separate the syringe and needle.**

Figure 4-GG: Placing syringe and needle in box



- **Reusable syringe and needle:** if the scale on a syringe cannot be read or the plunger does not fit properly in the barrel, place it in a disposal box.

---

When a needle becomes blocked or barbed, place it in a disposal box. Contaminated sharps should not be transferred from container to container. If containers are transported in a vehicle it should be protected against contamination or disinfected before being used for other purposes.

- **When the box is full, dispose of it by burning**

A manufactured disposal box can hold approximately 100 syringes and needles. When full it should be destroyed by incineration as close as possible to the point of use and as soon after the immunization session as is practical. The compound in which incineration takes place must be secure. Autocombustion incinerators, achieving temperatures above 800°C, are preferred, although burning can also be performed in other types of incinerator or, for instance, in a pit, drum or constructed hearth.

Some manufactured boxes come with their own fuel source. Approximately four minutes after you have lighted the box the syringes and needles inside start to burn. Depending on the type of syringe it takes at least an hour for them to be completely destroyed.

**Reusable** needles may not be completely destroyed by burning, but they cannot be reused and will pose no risk of transmission of blood-borne infections after burning. Care must still be taken to prevent needle-stick injuries by burying the remains, as described below.

In some countries, used needles and syringes are collected from health centres by the district supervisor. The supervisor is then responsible for disposing of them safely.

- **Bury the remaining debris**

The remains of the needles and disposal box should be buried after burning. Bury them deeply in a pit latrine, controlled landfill, or a similar location where people do not have access to them.

**Remember:**

**needles:**

**After using Treat used syringes and needles properly after every injection.**

**Reusable syringes and needles:**

- **Flush, soak and clean.**
- **Sterilize.**
- **When they can no longer be used, collect in a disposal box, burn and bury.**
- **Disposable syringes and once, collect in a disposal box, burn and bury.**

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## 4. Preventing injuries and infections

You can reduce the risk of injuries and infections when handling injection equipment as follows.

- 1) Take care to prevent injuries when:
  - using needles to give immunizations;
  - handling needles after giving immunizations;
  - cleaning needles and loading the sterilizer;
  - disposing of used needles.
- 2) Do not recap used needles; do not remove used needles from syringes by hand.
- 3) Place used syringes and needles in puncture-proof containers for disposal. Keep a container as close as possible to the place where you give injections.
- 4) Immediately and thoroughly wash hands and other skin surfaces that have been contaminated with blood or other body fluids.

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## 5. Supervision and evaluation

Systematic supervision and periodic evaluation of injection practices are vital to ensure safety. Supervisory visits should be made to each health centre at least twice a year, when a checklist should be used which includes a review of injection safety. An assessment of safe injection practices, injection equipment and the equipment supply system should be included in every EPI programme review and other evaluation activities. All injection-related adverse events should be routinely monitored and investigated with a view to improving the quality and safety of injections and assisting supervisory procedures.

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## 6. Budgeting and supply

An uninterrupted supply of injection equipment is essential for the safety of immunizations.

A reserve stock of disposable injection equipment amounting to at least 10% of the quantity used in each supply period should be kept at central and intermediate stores. At peripheral stores the reserve stock should be sufficient for at least one month of immunization activities.

A stock of reusable syringes and needles should be maintained which equals 10% more than the largest number of injections given in a single session, and there should be sufficient fuel for sterilization and adequate spare parts for the maintenance of steam sterilizers.

Puncture-resistant containers should be provided in sufficient quantities to all health units for the collection and incineration of contaminated syringes and needles.

A distribution system should be established for all injection equipment which is the same as that for vaccines, involving:

- 1) a timetable of regular supply dates;
- 2) an estimate of routine needs based on rates of use;
- 3) planning of needs for special immunization activities;
- 4) a record of current stock levels.

An adequate budget should be established one year in advance for the supply of sufficient injection, sterilization and disposal equipment to cover routine immunization, special immunization activities and, if necessary, the replenishment of reserve stocks.