

# Participant Handbook

Sector:  
**Electronics**

Sub-Sector:  
**Consumer Electronics**

Occupation:  
**After Sales Service**

Reference ID:  
**ELE/Q3104**

SCPwD Reference Code:  
**PWD/ELE/Q3104**



## Field Technician - Other Home Appliances

### (Divyangjan)

for Locomotor Disability  
for Speech and Hearing Impairment  
for Low Vision

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Electronics Sector Skills Council of India  
602-608, 6<sup>th</sup> Floor, Ansal Chambers-II, Bhikaji Cama Place  
New Delhi-110066  
E-mail: info@essc-india.org

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The book caters to the job role aligned to the following disabilities as per the NQR codes mentioned below.

For LD- 2021/PWD/SCPWD/04135

For LV- 2021/PWD/SCPWD/04136

For SHI- 2021/PWD/SCPWD/04137





**Shri Narendra Modi**  
Prime Minister of India

“

Skilling is building a better India.  
If we have to move India towards  
development then Skill Development  
should be our mission.

”



## Certificate

### COMPLIANCE TO QUALIFICATION PACK – NATIONAL OCCUPATIONAL STANDARDS

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### SKILLING CONTENT: PARTICIPANT HANDBOOK

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The need for having a standard curriculum for the Job Role based Qualification Packs under the National Skills Qualification Framework was felt necessary for achieving a uniform skill based training manual in the form of a Facilitator Guide.

I would like to take the opportunity to thank everyone who contributed in developing this Guide for the QP Field Technician – Other Home Appliances.

The Guide is the result of tireless pursuit to develop an effective tool for imparting the Skill Based training in the most effective manner.

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CEO

Electronics Sector Skills Council of India

## About this Book

This Facilitator Guide is designed to enable training for the specific Qualification Pack (QP). Each National Occupational (NOS) is covered across Unit/s. Key Learning Objectives for the specific NOS mark the beginning of the Unit/s for that NOS. The symbols used in this book are described below.

## Symbols Used



Key Learning  
Outcomes



Tips



Steps



Role Play



Unit Objective



Practical



Team Activity



Activity

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# 1. Basics of Electricity and Electronics



Unit 1.1 – Basics of electric circuits

Unit 1.2 – Components of an electric circuit



## Key Learning Outcomes



**At the end of this module, you will be able to:**

- Explain electric circuits
- Describe voltage, current and resistance
- Calculate power and energy
- Identify electronic components



## UNIT 1.1: Basics of Electric Circuits

### Unit Objectives

**At the end of this unit, you will be able to:**

- Describe electric circuits
- Describe voltage, current and resistance
- Define Ohm's Law
- Explain the difference between alternating current (AC) and direct current (DC)
- Measure power and energy
- Demonstrate the use of multimeter

### 1.1.1 Electric Circuit

It is a path made by the interconnection of electrical components. Electrons from a voltage or current source flow along this path. The following figure lists the elements present in a basic electric circuit:



A device in a circuit which consumes electric power is called load.

Example: Bulb



A source that provides electrical pressure known as voltage or EMF to electrical equipment to enable them to work.

Example: Battery



A conductor that connects the supply source and the load.

Example: Wires

*Fig 1.1.1: Electric circuit constituents*

An electric circuit consists of two paths/loops, as shown in the following image:



Closed Path



Open Path

*Fig 1.1.2: Closed and open path*

In a typical circuit, a battery provides voltage for the load through wires. For example, the required voltage for a bulb to glow is provided by a battery. The following image shows such an electric circuit:

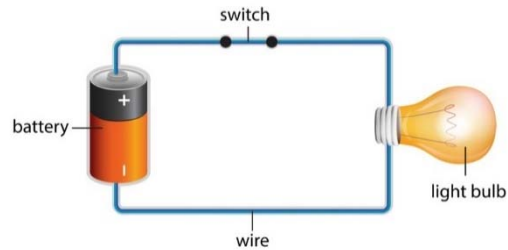


Fig 1.1.3: An electric circuit

## 1.1.2 Types of Electric Circuits

An electric circuit is classified into two types:

- Series circuit
- Parallel circuit

### Series Circuit

In this type of a circuit, all components are connected as a chain and the current flowing through each of them is the same all over the circuit. There is a single route through which the current flows. So, the current passes through each and every component. Opening or breaking any point of a series circuit causes the whole circuit to stop functioning which then needs to be replaced. The following image represents a series circuit:

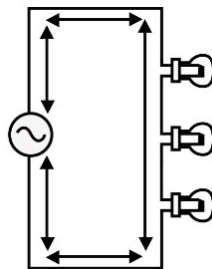


Fig 1.1.4: A series circuit

### Parallel Circuit

In this type of a circuit, two or more components are connected in a parallel manner. In a parallel circuit, the components are of the same voltage. The current flow varies across the components. If any point of the circuit gets damaged, only that part needs to be replaced.

The following image represents a parallel circuit:

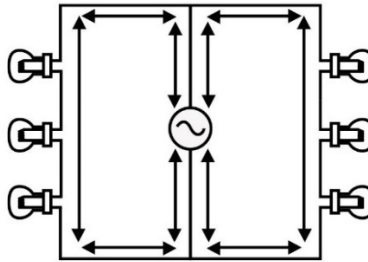


Fig 1.1.5: A parallel circuit

### 1.1.3 Parameters of Electric Circuit

Electricity is a natural force that comes into existence whenever there is a flow of electric charge between any two components. When working with circuits, awareness about some of the basic concepts of electricity is needed, otherwise wrong connection in a circuit may cause a high damage to the user and the circuit components. The main parameters associated with electricity are as follows:

- Voltage
- Current
- Resistance

#### Voltage

A force that causes electricity to move across the wire/cable is known as voltage. It can also be defined as the variance in the charge between the points of a circuit. Depending on the voltage, the electric current flows through a medium of a specific resistance. Volt is the unit of voltage and is denoted with letter V.

#### Current

Electric current, or simply current, is the flow of electric charge carried through electrons moving across wires. Ampere is the unit of current and denoted with letter I. The units of current are listed in the following table:

Unit	Denoted by
Micro-Ampere	( $\mu\text{A}$ ) = $10^{-6}\text{A}$
Millie-Ampere	(mA) = $10^{-3}\text{A}$
Ampere	(A)

## AC and DC Current

The following figure lists the two types of current sources that are dependent on the direction in which the electrons flow:

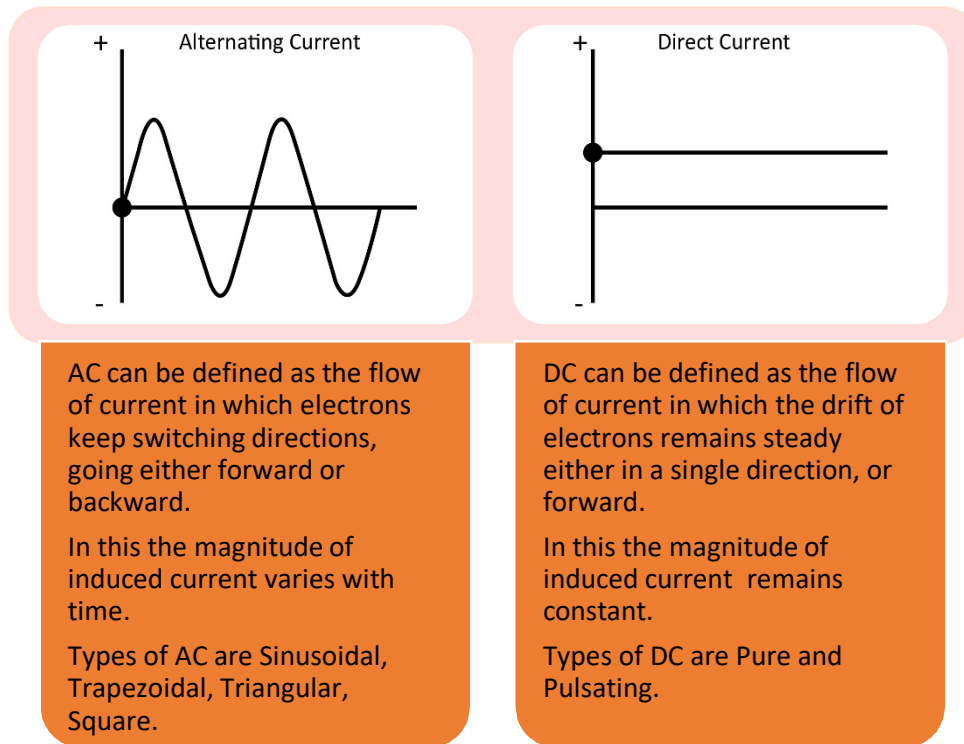


Fig 1.1.6: Difference between AC and DC current

## Resistance

Resistance, as the word suggests causes hindrance to any occurring force. In other words, it is an obstruction caused by a substance to the current flow. The unit of resistance is ohm and it is denoted with the symbol,  $\Omega$ . According to the ohm's law,  $1\Omega$  resistance allows  $1A$  of current to flow from one point to the other with a  $1V$  voltage difference.

### 1.1.4 Ohm's Law

According to Ohm's law, the flow of current through a conducting material is directly proportional to the conductor's voltage. The mathematical equation of Ohm's law is as follows:

$$I = V/R$$

Where,

$I$  is the current

$V$  is the potential difference

$R$  is the resistance



Ohm's law states that  $R$  in the preceding relation is constant and independent of the current flowing through it as shown in the following image:

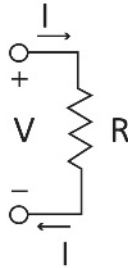


Fig 1.1.7: A simple electric circuit

### 1.1.5 Power Calculation and Energy Consumption

When electricity flows in an electric circuit, it results in some work done. For example, when it flows in a fan, the fan's blades rotate and when it flows in a refrigerator, it cools the things inside. Thus, when electricity flows through an appliance, it results in some work done. To calculate the electricity consumed, the following two parameters need to be considered:

- Power
- Energy

#### Power

The rate at which electrical energy flows through an electric circuit is known as Electrical power. Similar to mechanical power, electric power is the rate of doing electrical work, measured in watts (one joule per second) and denoted by  $P$ . The term wattage often refers to electric power in watts.

Thus, to denote the electric power (in watts) given by an electric current  $I$  consisting of a charge of  $Q$  coulombs in every  $t$  seconds through an electric potential (voltage) difference of  $V$ , use the following equation:

$$P = \text{work done per unit time} = \frac{VQ}{t} = VI$$

#### Energy

If the electric power is the rate or speed of work done, then electric energy is the total amount of work done in a given time period. It is a product of the power of an electrical appliance and the duration of its usage. Electric energy can be explained with the following equation:

$$\text{Electrical Energy (E)} = \text{Power (P)} \times \text{Duration of Energy usage (T)} = \text{Power (Watt)} \times \text{Time (hour)}$$

$$E \text{ (Wh)} = P \text{ (W)} \times T \text{ (h)}$$

$$\text{Power} = \text{Energy} / \text{Time}$$

Example:

Electricity charges are paid based on "Units of Consumption"

$$1 \text{ unit} = 1 \text{ kwh}$$

If 500w is used for a device for 4 hours, then consumption is =  $0.5 \text{ kw} * 4 \text{ Hrs.} = 2 \text{ Kwh}$  (2 units). By multiplying the power consumption with rate of electricity, the electricity bill for the usage is determined.

## 1.1.6 Measurement of Electrical Parameters

There are many types of measuring tools available to measure voltage, current, power and energy. Some of the measuring tools are:

- Multimeter
- Clamp meter

### Multimeter

A multimeter can be used for measuring voltage, current and resistance. It can also be used for fault detection in small circuits or to find out the broken wires in a circuit. It can be of two types:

- Analog Multimeter
- Digital Multimeter

The following figure shows the different types of multimeters:

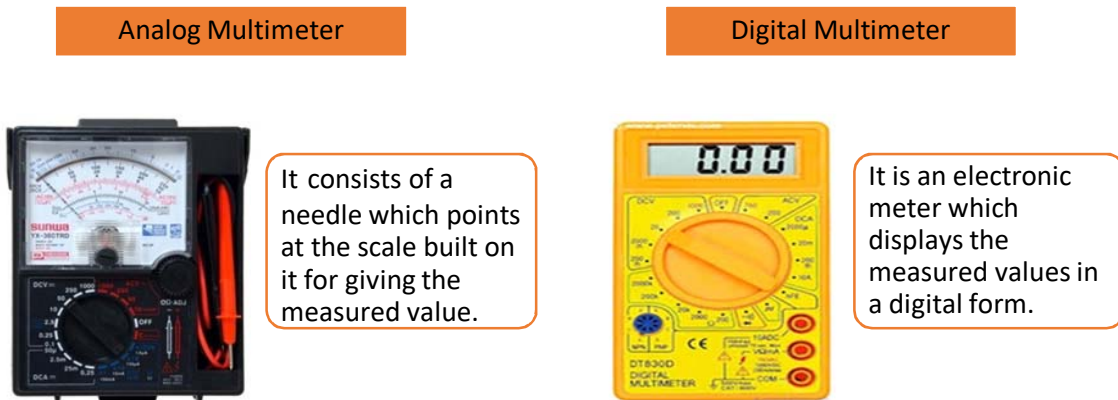


Fig. 1.1.8: Types of multimeters

Usually, a standard multimeter can measure the following electrical quantities:

- DC Voltage
- DC Current
- AC Voltage
- AC Current
- Resistance

## Clamp Meter

An electrical tester which combines a multimeter with a current sensor is known as a clamp meter. The probes in the device measure voltage, whereas the clamps measure the current. The clamps are the hinged jaws joined to an electric meter that allows users to clamp around the cable/wire anytime for measuring the current without disturbing any other element. While using a clamp meter, the wire/cable to be measured is not disconnected. The following images shows types of clamp meter:



*Fig. 1.1.9: Types of clamp meters*

Usually, a standard clamp meter can measure the following electrical quantities:

- AC current
- Temperature
- AC voltage
- Capacitance
- DC voltage
- Resistance
- DC current
- Frequency

## Activity: Identification Game



Answer the following questions.

1. Which of the following equipment is used to measure voltage?



Clamp meter



Megger



Ammeter

2. What is the mathematical equation of Ohm's law?

$I = P/V$

$I = V/R$

$P = -VQ/t$

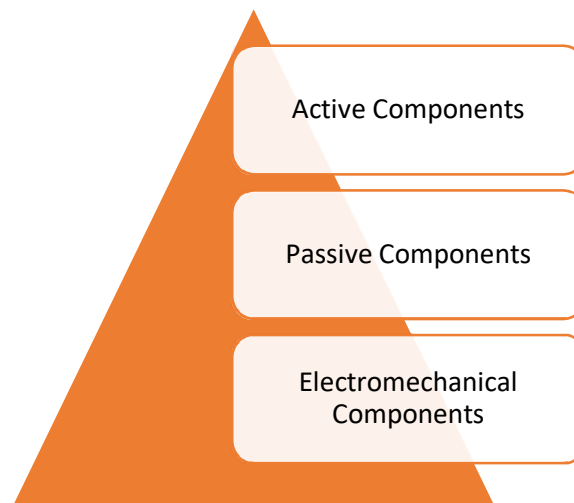
## UNIT 1.2: Components of an Electric Circuit

### Unit Objectives

**At the end of this unit, you will be able to:**

- Identify the active components
- Describe the passive components
- List electromagnetic components

A circuit consist of a number of components that may be electrical, electronic, mechanical and so on. The following figure represents various types of circuit elements or components that are used in a control panel:

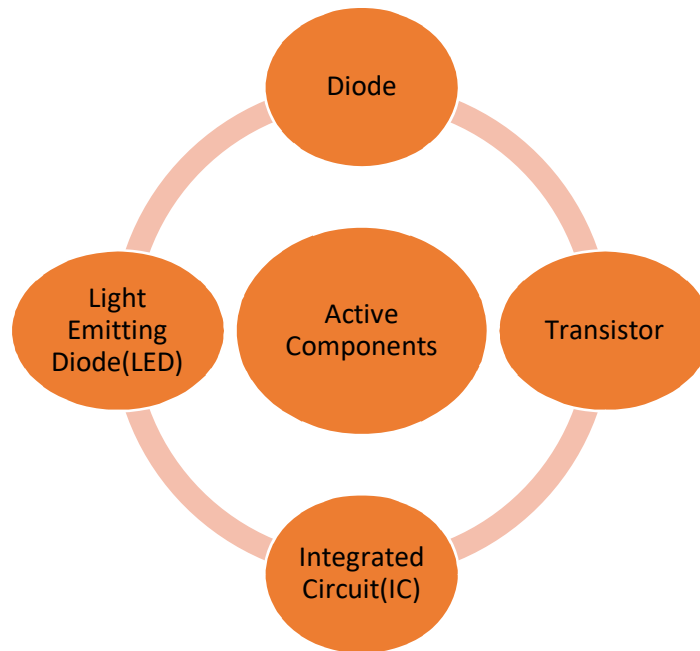


*Fig. 1.2.1: Circuit elements*

### 1.2.1 Active Components

Active components depend on a source of energy to perform their functions. These components can amplify current and can produce a power gain.

The following figure lists the different types of active components in a circuit:



*Fig. 1.2.2: Active components*

## Diode

A diode is a specialized electronic component with two terminals known as the anode and the cathode. It has asymmetric conductance, which means that it conducts mainly in one direction. It has very less resistance, ideally zero, to the flow of current in one direction whereas it has high resistance, ideally infinite, in the other direction. Diodes are usually made up of semiconductor materials such as germanium, silicon or selenium. Appliances such as microwave oven, water purifier and mixer/ juicer/ grinder have this component. The following image shows diodes:



*Fig. 1.2.3: Diodes*

## Transistor

A transistor is an electronic device, made up of semiconductor material. Usually, it consists three or more terminals for connecting to an external circuit. It is utilized to amplify or switch electrical power and electronic signals. Appliances such as microwave oven, water purifier and mixer/juicer/grinder have this component.

The following image shows a transistor:



*Fig. 1.2.4: A transistor*

## IC

An IC, also known as a microchip, is a semiconductor wafer on which a number of small resistors, capacitors and transistors are fabricated. It can work as an oscillator, an amplifier, a timer, a counter, a microprocessor or as computer memory. Appliance such as microwave oven, water purifier and mixer, juicer and grinder has this component. The following image shows an integrated circuit:



*Fig. 1.2.5: Integrated Circuit (IC)*

## LED

An LED is made of a p-n junction diode which releases light when it is activated. It is a two-lead semiconductor source of light. Energy is released as photons when a suitable voltage is applied to the leads. Appliances such as microwave oven, water purifier and mixer/ juicer/grinder have this component. The following image shows an LED:

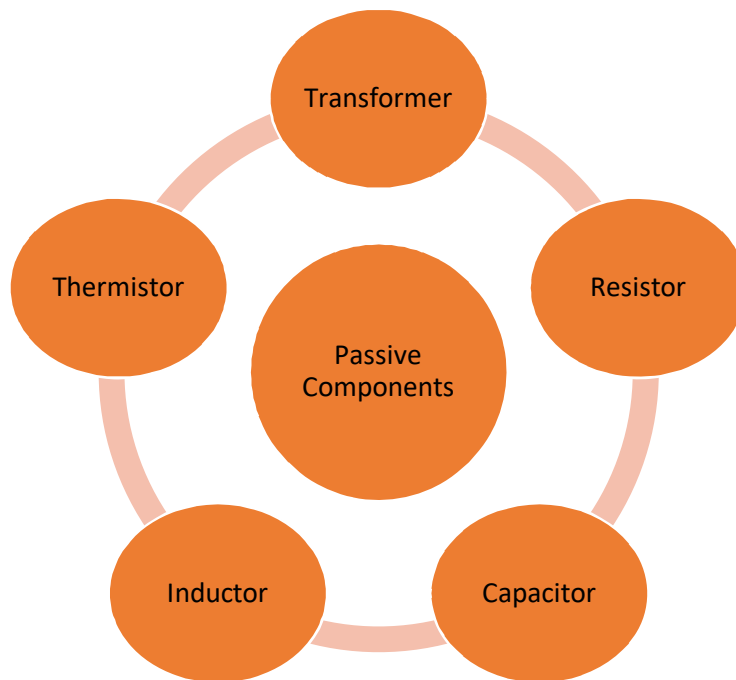


*Fig. 1.2.6: An LED*

## 1.2.2 Passive Components

Passive components are those components which can perform their specific functions without any power source. These components are incapable of controlling current.

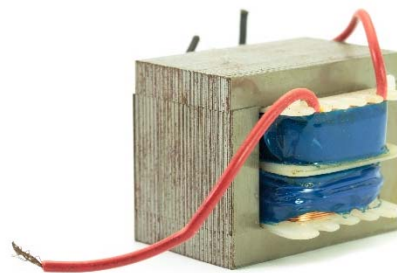
The following figure lists the different types of passive components in a circuit:



*Fig. 1.2.7: Passive components*

## Transformer

A transformer consists of a metal core with coils of wire around it. It is a device used to convert alternating current (AC) to the required values by decreasing or increasing the alternating voltages in an electronic or electric system. Appliances such as microwave oven, water purifier and mixer/ juicer/ grinder have this component. The following image shows a transformer:



*Fig. 1.2.8: A transformer*

## Resistor

A resistor is a component in an electronic circuit which is built to resist or limit the flow of current in that circuit. It may be a small carbon device or big wire-wound power resistor. Its size varies in length from 5mm up to 300mm. Appliances such as microwave oven, water purifier and mixer/ juicer / grinder have this component.



The following image shows resistors:



*Fig. 1.2.9: Resistors*

## Capacitor

A capacitor is a device which is made up of one or more pairs of conductors and an insulator separating them. It is used to store electric charge. Appliances such as microwave oven, water purifier and mixer/ juicer / grinder have this component. The following image show capacitors:



*Fig. 1.2.10: Capacitors*

## Inductor

An inductor consist of a coil or a wire loop. This component is used to store energy in form of magnetic field. The more the turns in the coil, the more will be the inductance. Appliances such as microwave oven and water purifier have this component. The following image shows inductors:



*Fig. 1.2.11: Inductor*

## Thermistor

A thermistor is a kind of resistor which is more sensitive to temperature as compared to other resistors. It is extensively used as an inrush current limiter, temperature sensor, self-regulating heating element and self-resetting overcurrent protector.

Appliances such as microwave oven and mixer/ juicer/ grinder have this component. The following image shows a thermistor:



Fig. 1.2.12: A thermistor

## 1.2.2 Electromechanical Components

Electromechanical components convert electric energy to mechanical energy (mechanical movement) or vice versa for carrying out electric operations. The following figure lists various electromechanical components:

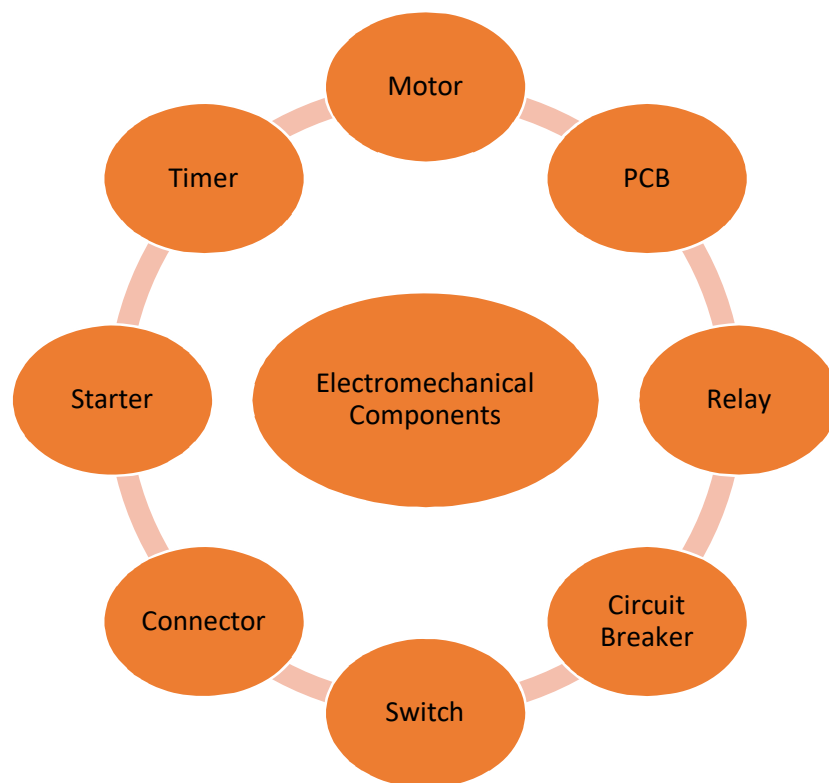
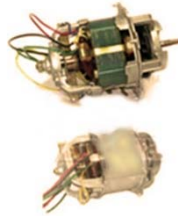


Fig. 1.2.13: Electromechanical components

### Motor

A motor is an electrical component which is used to transform electrical energy into mechanical energy to produce linear or rotary force. Unlike magnetic solenoids, they generate usable mechanical powers.

In a normal motoring mode, force is generated inside the motor through the interaction between its winding currents and magnetic field. Appliances such as water purifier and mixer/ juicer / grinder have this component. The following image shows the motor used in a mixer grinder:



*Fig. 1.2.14: A Mixer grinder motor*

## Printed Circuit Board (PCB)

A PCB acts as a base for the components that are mounted on its surface and interconnected with wires, conductive tracks and so on. The components are generally soldered on the circuit board according to the specified design. Appliances such as microwave oven, water purifier and mixer /juicer/ grinder have this component. The following image shows a PCB:



*Fig. 1.2.15:A PCB*

## Connector

A connector is a device which is used to join two circuits together. The connector may be a port, a plug, a cable connector and so on. All appliances have this either in the form of a cable connector or a plug, as shown in the following image:



*Fig. 1.2.16: Plug*

## Switch

A switch is a component used to make or break connections in an electrical circuit. A switch is used to divert the current from one conductor to another one. It can be operated manually to control a circuit such as a light switch or can be operated by a moving object. It is made to control a wide range of currents and voltages.

The following image shows a typical switch used in small appliances such as a mixer/ juicer/ grinder:



Fig. 1.2.17: A rotary switch

## Relay

A relay is a switch that controls an electrical circuit by opening and closing contacts in another circuit, electromechanically or electronically. In electromechanical relays, the opening and closing of contacts is done by a magnetic force. In solid state relays, the switching is electronic as there are no contacts. Appliances such as microwave oven and water purifier have this component. The electromechanical relays are operated by an electromagnet which is a coil of wire wrapped round an iron core. The following image shows both the relays:



Fig. 1.2.18: Solid state relay and electromagnetic relay

## Circuit Breaker

A circuit breaker is a requisite component of an electrical power system required for its control and protection. It is a switching device which can be operated manually as well as automatically. Its main function is to shield an electric circuit from harm caused by overload or short circuit. It interrupts the current flow when protective relays find out a fault. Appliances such as microwave oven and mixer/ juicer/grinder have this component. The following image shows a circuit breaker:



Fig. 1.2.19: A circuit breaker

## Starter

A starter is a device that is used to start, stop, reverse and protect a motor. It controls the supply of electric power to the motor. It has two important parts, contactors and overload protection. Appliances such as microwave oven and mixer/ juicer /grinder have this component. The following image shows a starter:



*Fig. 1.2.20: A starter*

## Timer

A timer, also known as a time switch, is a special type of clock that measures time intervals. It operates a switch that is controlled using a timing device. A timer may be built into a power circuit such as a water heater timer. It may also be built into the equipment such as a timer that turns off cooking in microwave oven after a set period. The following image shows an appliance that has it:



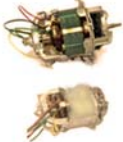






*Fig. 1.2.21: A timer*

## Activity: Identification Game

Look at the components typically used in home appliances.

Match the images with their names.

1. Solid state relay	
2. Timer	
3. Inductor	
4. Starter	
5. Motor	
6. PCB	
7. Plug	

## 2. Role of a Field Technician of Other Home Appliances



Unit 2.1 – Introduction to FT-OHA

Unit 2.2 – Work Standards and Safety

Unit 2.3 – Equipment and Appliances Used



## Key Learning Outcomes



**At the end of this module, you will be able to:**

- Define a field technician and his/her key responsibilities
- Maintain working standards
- List safety rules
- Explain types of equipment used
- Categorize home appliances



## UNIT 2.1: Introduction to FT-OHA

### Unit Objectives

**At the end of this unit, you will be able to:**

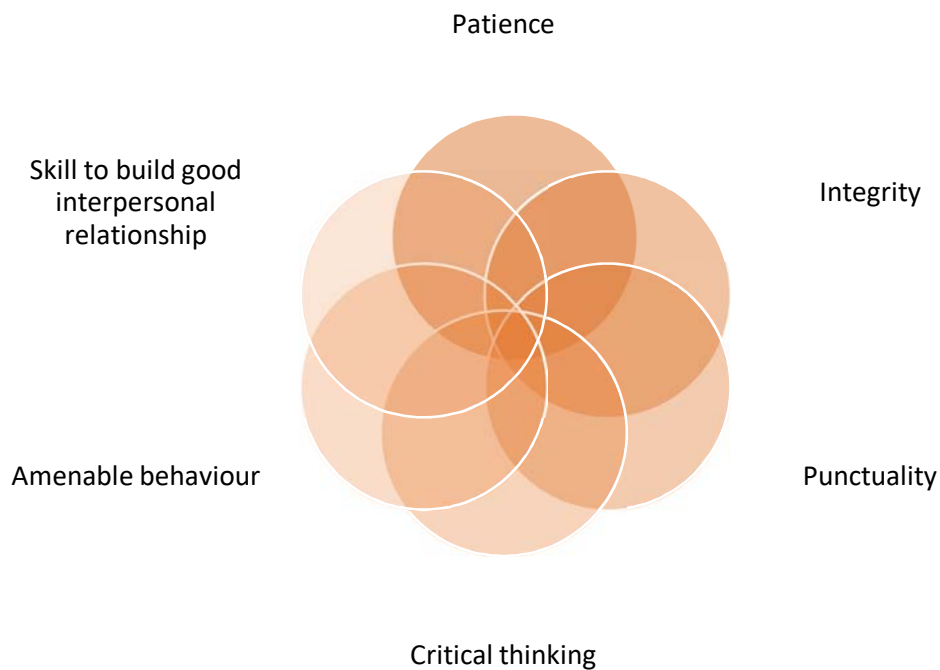
- Describe the role of an FT-OHA
- Identify the responsibilities of an FT-OHA

### 2.1.1 Who is a Field Technician?

Technicians who have specialized technical knowledge for installing, repairing and maintaining the industry equipment, on or off customer site, are called field technicians. Their work is dependent on the type of equipment they are skilled in. For instance, if a person is skilled in installing, servicing or repairing home appliances then he/she may be known as field technician for home appliances.

Other home appliances' field technician has an after sales service job of installing and providing support related to typical small home appliances such as water purifier, mixer/juicer/grinder and microwave oven. Technicians generally conduct site visits to install or repair these appliances.

The following figure shows some of the attributes that a FT-OHA must possess:



*Fig. 2.1.1: Attributes of a technician*

## Patience

Being patient helps an individual to work efficiently when a particular situation is solvable.

An individual with patience proves to be:

- Efficient in work, especially in time of crisis.
- Capable of managing clients with high temper.

## Integrity

Possessing integrity stretches to all aspects of an employee's job. An individual with integrity promotes:

- Trusting relationships with clients.
- Good interaction with colleagues and supervisors.

## Punctuality

An individual should be punctual as it helps in:

- Being organized.
- Being aware of the timelines.
- Planning the day's activities and the complete work plan for each installation.

## Critical Thinking

An individual must have critical thinking as it helps to:

- Analyse and evaluate the issue in order to form a judgment.
- Take decision wisely.

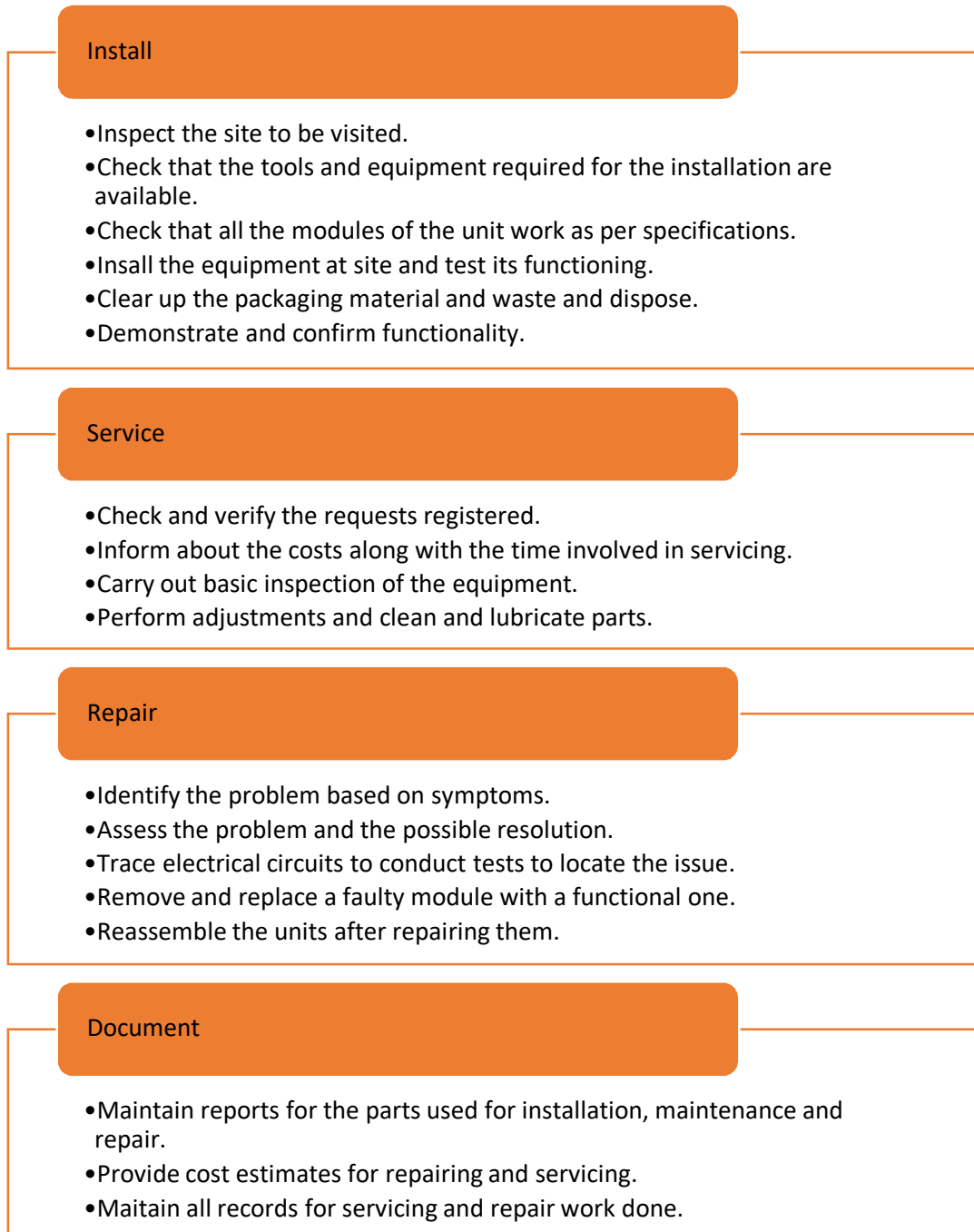
## Skills to Build Good Interpersonal Relationship

Building a good interpersonal relationship helps an individual to:

- Work as a team member for achieving smooth workflow and a satisfied customer
- Communicate the constraints and quality requirements to the team
- Build team coordination

## Responsibilities of an FT OHA

The key responsibilities of a technician are as listed in the following figure:



*Fig. 2.1.2: Key responsibilities of a technician*

## 2.1.2 Working Knowledge

In order to perform work such as installing and repairing, a technician must have basic knowledge of wiring and tools and equipment that he has to work with/upon.

### Domestic Wiring

In our homes, we receive power supply through a main supply. These are either supported through overhead electric poles or by underground cables. The electric power line entering our house follows a color code for insulating these wires to avoid confusion:

- Red wire: live wire
- Black wire: neutral wire
- Green wire: Earth wire

The live wire has a high potential of 220 volts whereas the neutral wire has zero potential. Thus, the potential difference between the live wire and the neutral wire is  $220-0 = 220$  volts. The following image shows schematic diagram of one of the common domestic circuits:

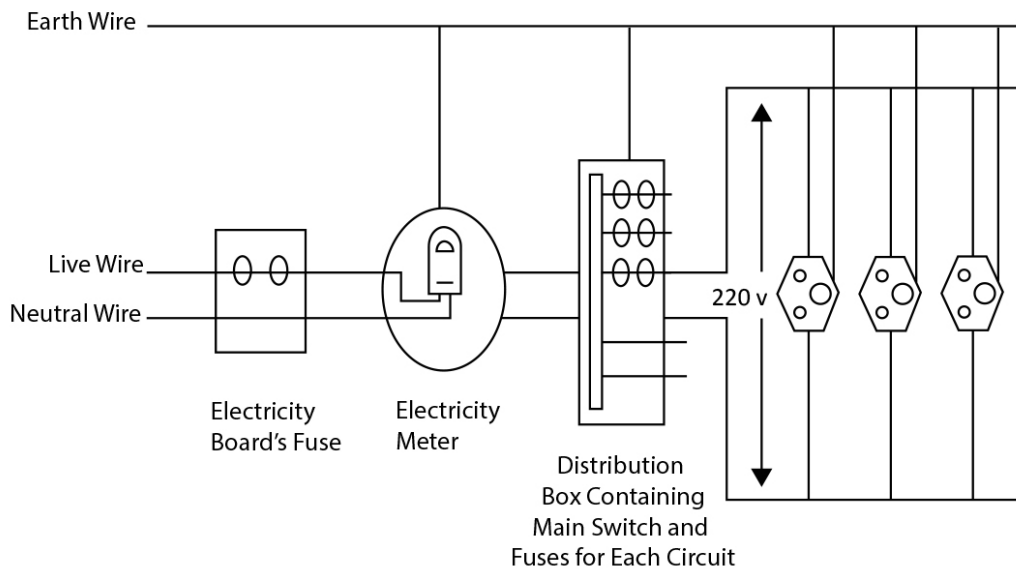


Fig. 2.1.3: Common domestic circuits







Both live wire and neutral wire, comes from an electric pole, then it is entered in a box fitted outside the house which consists main fuse.



A fuse is a piece of wire of a material with a very low melting point. This wire is connected in series to the “live wire”. When a short circuit occurs due to high current flow, the wire heats up and melts due to which the circuit breaks and the current stops flowing.

### Tools used by a Technician

There are various tools used by a technician for performing tasks such as installation and repairing of dysfunctional appliances.

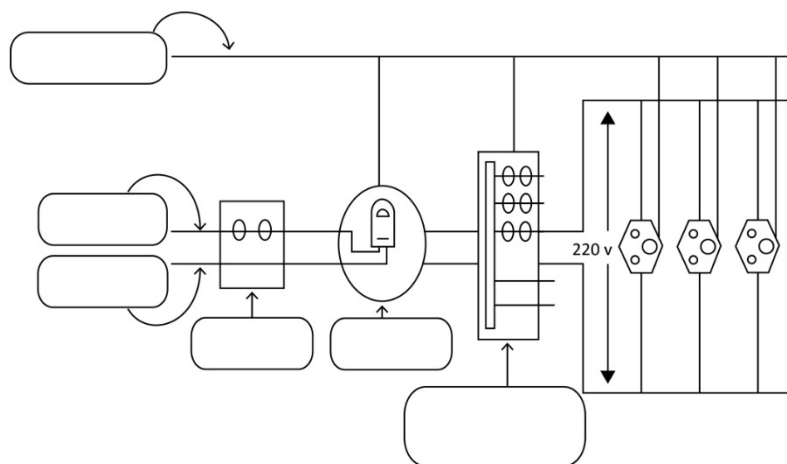
The following table lists some of the tools used by a technician:

Name	Function	Image
<b>Wire cutter</b>	Used for cutting wires	
<b>Pliers</b>	Used to hold objects firmly	
<b>Tester</b>	Used to verify presence of electric voltage in an equipment	
<b>Hammer</b>	Used to drive nails, fit parts, or forge metal	
<b>Wrench</b>	Used to provide grip for applying torque to either loosen or tighten an object.	
<b>Screwdriver</b>	Used for turning screws.	

<b>Multimeter</b>	Used to check current, voltage and resistance in electronics equipment and check continuity between two points.	
<b>Clamp meter</b>	Used to measure current flowing through a conductor.	

## Activity: Identification Game

Identify and label all the components of the given circuit diagram.



## UNIT 2.2: Work Standards and Safety

### Unit Objectives

**At the end of this unit, you will be able to:**

- Maintain working standards
- Identify safety rules

### 2.2.1 Working Standards

The following figure lists the standards that a technician must follow:

Checking all the tools required for installing/repairing are working properly

Organizing all the tools required for installing/repairing appropriately

Operating and checking whether the product is in a safe and stable condition

Disposing the waste material appropriately after installing/repairing the appliance

Documenting all the necessary documents/payments

*Fig. 2.2.1: Working standards followed by a technician*

### 2.2.2 Safety Rules

The following figure lists the safety rules that should be followed while working with an electrical appliance:

Dos	Don'ts
<input type="checkbox"/> Ensure leads are not cut, frayed or worn-out. <input type="checkbox"/> Check the wire is not bare at any point. <input type="checkbox"/> Pull the plug out before using the appliance <input type="checkbox"/> Stay away from the appliance's electrical equipment.	<input type="checkbox"/> Yank the cord for disconnecting the plug. <input type="checkbox"/> Overload sockets. <input type="checkbox"/> Run extension leads through wet floor. <input type="checkbox"/> Poke finger in the sockets. <input type="checkbox"/> Touch the appliance when one is wet.

*Fig. 2.2.2: Safety rules*



The following figure shows some of the injuries that can happen while working with an electrical appliance:

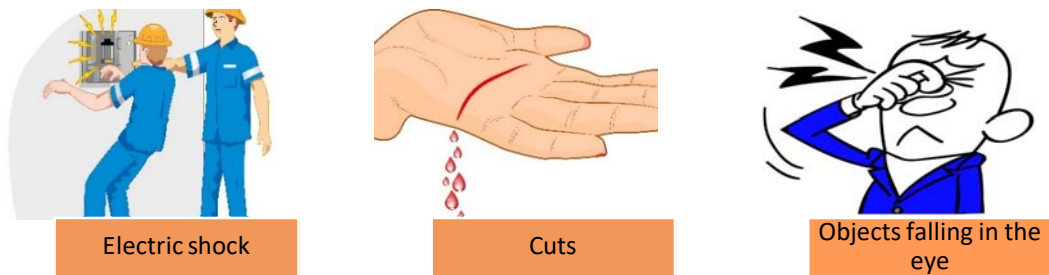


Fig 2.2.3: Types of injuries

To overcome these injuries, we must provide first-aid as per the injury:

- The following figure lists the steps of first-aid in case of an electric shock:

Stop the electricity source.

Use a non-conducting, dry object made up of either wood or plastic to move the electric source away from the injured.

Perform Cardiopulmonary Resuscitation(CPR) in case the person shows no sign of body movement or air circulation.

Keep the injured person warm.

Cover the burned area with a clean cloth or a sterile gauze, if available. Avoid using a blanket or a towel.

Fig. 2.2.4: First-aid in case of an electric shock

- The following figure lists the steps of first-aid in case of cuts:

Put pressure on the wound until bleeding stops.

Take off rings and bracelets as it may compress the nerves or prevent the blood flow.

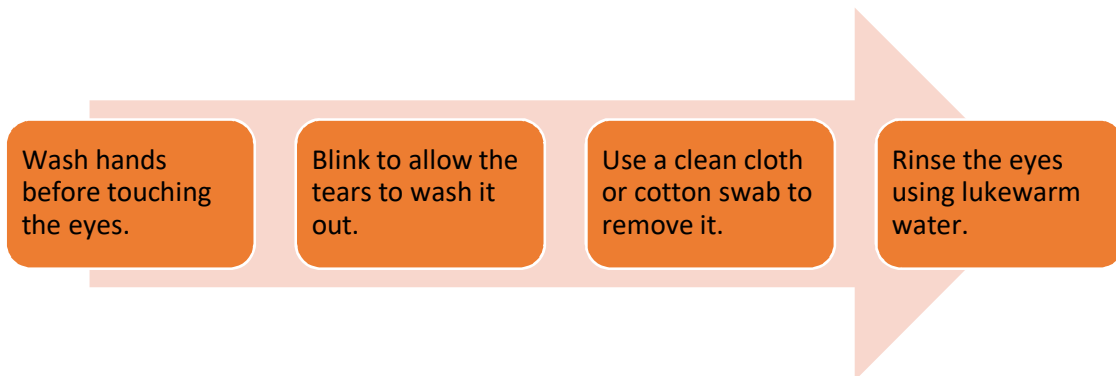
Use warm water and soap to clean the area.

Cover the wound by applying an antibiotic ointment and a sterile bandage.

Elevate the hand and then apply ice to reduce the swelling.

Fig. 2.2.5: First-aid in case of cuts

- The following figure lists the steps of first-aid in case an object fall in the eye:



*Fig. 2.2.6: First-aid in case an object falls in the eye*

**Activity: Identification Game**

Match the mishaps with the steps that are typically performed to deal with them.

1. Perform CPR	i. Cut
2. Use a clean cloth or cotton swab to remove it.	ii. Electric shock
3. Elevate the hand and then apply ice	iii. Object falling in the eye

**Activity: Role Play** 

For hanging an appliance on a wall, you started drilling using a power drill. Suddenly a particle of cement fell in your colleague's eyes. What will you do? Fill in the blank steps to complete the procedure.

**Steps:**

\_\_\_\_\_ before touching the eyes.



\_\_\_\_\_ to allow the tears to \_\_\_\_\_.



Use \_\_\_\_\_ to remove it.



Rinse the eyes using \_\_\_\_\_.

## UNIT 2.3: Equipment and Appliances Used

### Unit Objectives

**At the end of this unit, you will be able to:**

- List the equipment used by a technician
- Recognize the categories in which appliances are divided

### 2.3.1 List of Equipment and their Usage

There are various equipment used while installing a home appliance. Some of these are:

- Rotary tubing or pipe cutter
- Tubing bender
- Power drill

#### Rotary Tubing or Pipe Cutter

Pipe cutter and rotary tubing, both have a similar design. They have a structure like a C-clamp, one side stationary support and the other side adjustable support mounted at the end of an adjustment screw. These cutters have a roller wheel and a cutting wheel, where one is movable and the other is stationary. They are usually used to cut the tubes/pipe used during installation of a water purifier. The following image shows a pipe cutter:



*Fig. 2.3.1: Tube/pipe cutter*

#### Usage

To use the tube/pipe cutter follow the given steps:

1. Open the tool:
  - a. Loosen the screw.
  - b. Retract the cutting wheel or rollers.
2. Slide the tubing or pipe into the tool.
3. Turn the adjustment screw to bring the cutting wheel and the roller wheels in contact with it.
4. Rotate the tool around the clamped tubing or pipe to begin the cutting process.

5. Tighten the adjustment screw after one full rotational pass to engage the cutting wheel deeper into the tubing or pipe.
6. Debus inner edge of the cut, as soon as the tubing or pipe is cut.

### Tubing bender

An equipment used to provide consistent and accurate bends on various tubes, such as steel tubes, copper tubes and aluminum based tubes, is known as a tubing bender. This equipment can be used for bending pipe of any size. They are usually used to bend the tubes/pipe which may need to be connected to large pipes. The following image shows one of the bulky bending machines used for bending large pipes:



*Fig. 2.3.2: A tube/pipe bender for large pipes/tubes*

This equipment is also used to bend the tubes/pipe which may need to be connected to small pipes during installation of a water purifier. The following image shows a manual bender used for bending small sized pipe/tubes:



*Fig. 2.3.3: A manual tube/pipe bender for small pipes/tubes*

Manual tubing requires minimal training. These tubes can be used to bend the pipes up to 180° in a finished form.

### Usage

Steps to be followed while using a tubing bender are:

- Choose an appropriate tubing bender:
  - Use an appropriate tool for the particular application.
- Set up the tubing bender:
  - The bending tool consists an adjustment dial that should be set based on the radius that is desired for the tube as well as the overall number of degrees required in the bend.

- Mark bend directions and reference points:
  - Mark the tube with a reference longitudinal line.
  - The line should be towards the direction that is opposite to the bend direction desired.
- Align and insert the tube into the bender:
  - Swing up one bending arm to insert the tube into the bending die, ensuring that the reference marks are visible.
  - Lower the second arm using the latch mechanism to hold the tubing in place while allowing for minor adjustments.
- Start the bending process:
  - Firmly grip the roll support arm while bringing it down until the required degree mark is reached on the bending die.
  - Be careful for any spring back during the process.
- Disengage the tube from the bender:
  - Unlatch and disengage the tube from the die by lifting up the roll support arm, now remove the finished tube from the tube bender.

## Power Drill

The power drill is used for fastening various objects together using fasteners or boring holes into various objects. “Bits” and “drill bits” can be attached to it to match whatever screw it is to be used for, allowing to drill holes into various things. The following image shows a power drill:



*Fig. 2.3.4: A power drill*

Power drill is generally used for:

- Screwing jobs, for example in construction activities or during assembly of parts of big machineries or appliances such as a water purifier, mixer or a microwave oven
- Drilling holes into various objects such as a wall or another surface to install an appliance, such as a water purifier, at a stationary position
- Dentistry, but the power drill is of a different kind.

The following figure shows two other important components of a power drill:

Button	Torque
<ul style="list-style-type: none"> <li>• It is responsible for the direction of the drill, whether it will go forward (clockwise) or backward (anti-clockwise).</li> <li>• It is present near the trigger.</li> </ul>	<ul style="list-style-type: none"> <li>• It is responsible for setting the screw as required.</li> <li>• For driving screws set 1, it has low speed/high torque.</li> <li>• For either drilling or driving set 2, it is a medium speed/torque.</li> <li>• For either drilling or driving fasteners set 3, it has the highest speed.</li> </ul>

*Fig. 2.3.5: Components of a power drill*

### Usage

To use the power drill, follow the given steps:

1. Loosen
2. Put the bit into the chuck
3. Tighten. Ensure it is properly done.

## 2.3.2 List of Appliances

Home appliances are electrical/mechanical machines which perform some of the household functions, such as cooling/heating, cooking or cleaning. They can be classified into:

- Major appliances
- Small appliances



The following figure lists the appliances categorized under the given classification:

	<b>Major appliances</b>		<b>Small appliances</b>
Microwave ovens		Fans	
Freezers		Heaters	
Dishwashers		Mixers	
Induction cookers		Juicers	
Drying cabinets		Grinders	
Air conditioners		Food processors	
Washing machines		Toasters	
Refrigerators		Electric kettles	
Water heaters		Coffee makers	
Water purifiers		Blenders	
Clothes dryers		Waffle irons	
Kitchen stoves		Dough blenders	

*Fig. 2.3.6: List of home appliances*

A field technician needs to be able to install and service appliances such as a water purifier. Moreover, a field technician should also be able to service and repair other home appliances such as juicer, mixer, grinder and microwave oven.

### Activity: Identification Game



Answer the following questions.

1. Which equipment looks like a C-clamp?

Power drill

Tubing cutter

Tubing bender

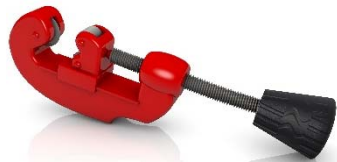
2. Which of the following appliances is categorized under the small appliance category?

Kitchen stove

Microwave oven

Dough blender

3. Which equipment is used to bend a tube/pipe?



4. Which type of equipment is used at a dentist's clinic?

Power drill

Tubing cutter

Tubing bender

**Activity: Role Play**

Your colleague is using a tubing bender for the first time. He has to be briefed about its working, safety measures to be adopted and so on. The supervisor has assigned this task to you. Perform the role play.

**Hints:**

- You are the technician who has been assigned the task by the supervisor.
- Another participant acts as a colleague.
- How would you guide the colleague and giving necessary details about the tool and its safety measure?



## 3. Basics of Water– Based Appliances



Unit 3.1 – Properties of Water affecting Water-based Appliances

Unit 3.2 – Water treatment methods



## Key Learning Outcomes



**At the end of this module, you will be able to:**

- List the properties of water affecting water-based appliances
- Describe water treatment methods
- List different types of filters

## UNIT 3.1: Properties of Water Affecting Water-based Appliances

### Unit Objectives

**At the end of this unit, you will be able to:**

- Identify the importance of water and its requirements
- List the properties of water affecting water-based appliances

### 3.1.1 Water

Water is the most abundant compound found on Earth and is essential for the survival of all life forms. More than 70% of Earth's surface is covered with water in the form of snow, glaciers, oceans, rivers and lakes. It is the only substance on earth that exists in all three physical states, in liquid state at standard temperature and pressure, in solid state as ice and in gaseous state as water vapor.

However, very little of this water is drinkable, as 96% of the Earth's water is salt water. Around 98% of the remaining freshwater is in the form of glaciers and polar ice caps. This leaves just about 1% of the freshwater on the surface in the form of rivers and lakes. Not all of this freshwater is safe for human consumption as it is contaminated with bacteria.



To make fresh water safe for drinking, it needs to be cleaned so that its intake does not cause any harm. The various properties of water make it a necessity for supporting life.

### 3.1.2 Properties of Water

Water is a transparent, odorless, tasteless and colorless liquid. Its chemical name is  $H_2O$  and it is made up of two hydrogen atoms and one oxygen atom joined together by covalent bonds.

The following figure lists the various properties of water:

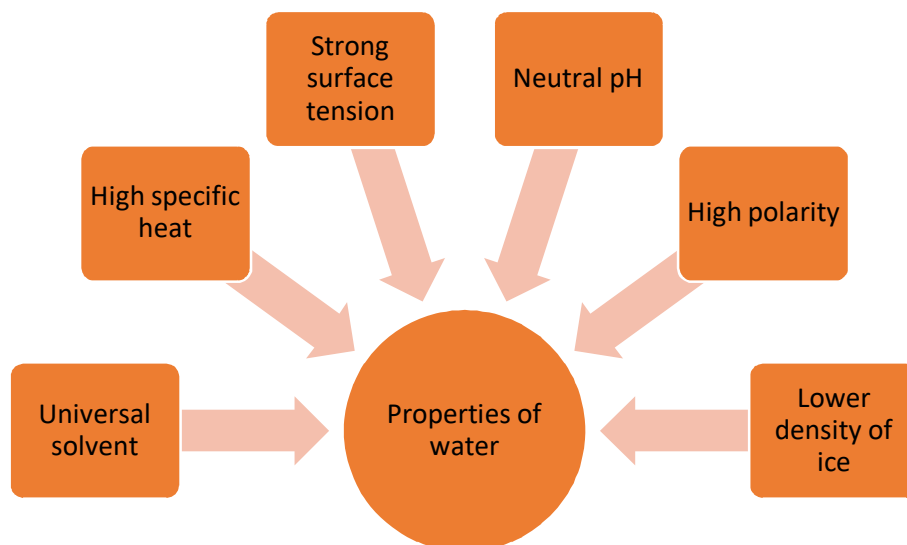


Fig 3.1.1: Properties of water

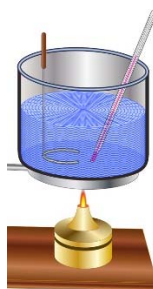
## Universal Solvent

Water can form hydrogen bonds and this property makes it a powerful solvent. It can dissolve a large number of different chemical substances. It is this dissolving power of water that supports life on Earth by carrying dissolved nutrients, minerals and chemicals wherever it goes.



## High Specific Heat

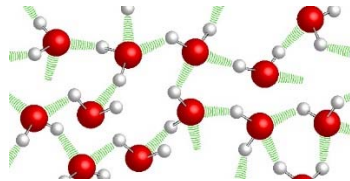
Water has a high specific heat capacity. Specific heat refers to the amount of heat needed to alter the temperature of a substance. Water can absorb and store a lot of heat before it gets hot. This enables it to moderate earth's temperature.





## Strong Surface Tension

Water has a high surface tension. Its high polarity makes its molecules strongly attracted to each other. Its molecules are adhesive and form a layer on its surface. High surface tension is responsible for the capillary action of water and enables it to move through plant roots and stems and even blood vessels in animals.



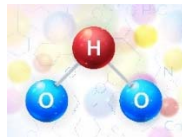
## Neutral pH

Water is neither acidic nor basic; it has a neutral pH value 7.



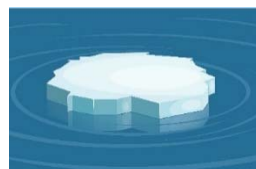
## High Polarity

Water has a high polarity. The hydrogen and oxygen molecules join at an angle with the oxygen atom at vertex and the hydrogen atoms at tips. The difference in the electro negativity of oxygen and hydrogen atoms makes water a strong polar compound.



## Lower Density of Ice

The density of ice is lower than the density of water. Water expands when it freezes and its molecules form a crystalline structure which is less dense than liquid water. This enables the ice to float on water and prevent oceans, lakes and rivers from freezing, thereby allowing life to exist on Earth.



### Activity: Group Discussion



More than 70% of Earth's surface is covered with water in the form of snow, glaciers, oceans, rivers and lakes. Still there is lack of water. Discuss.

## UNIT 3.2: Water Treatment Methods

### Unit Objectives

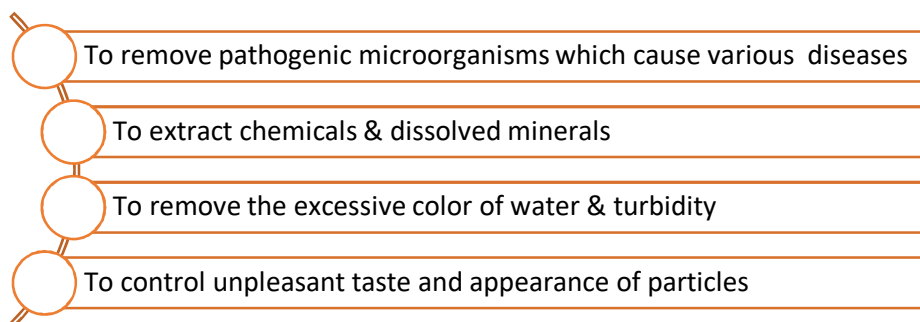
**At the end of this unit, you will be able to:**

- List the various water treatment methods
- Describe the different types of filters
- Explain the water purification process

### 3.2.1 Water Treatment

Clean and safe water is critical for everyday life. Very little of the water found in nature is drinkable as it is contaminated with virus, bacteria and parasites. This water needs to be treated before it can become useful. Water treatment is the process of removing pathogenic micro-organisms which have entered water and making it fit for use.

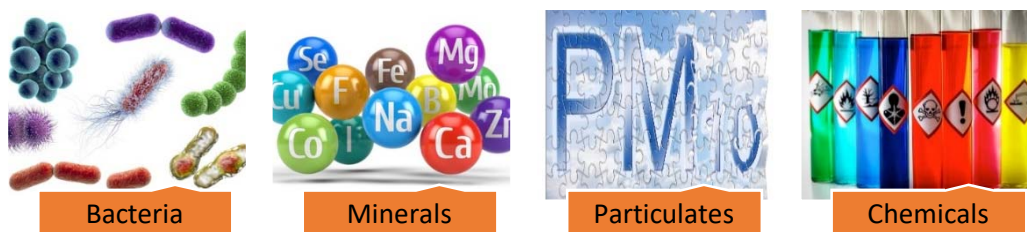
The following figure lists the purpose of water treatment:



*Fig. 3.2.1: Purpose of water treatment*

### 3.2.2 Water Treatment Methods

There are four common types of contaminants that are generally found in water. These are shown in the following figure:



*Fig. 3.2.2: Contaminants in water*

## Bacteria

Bacteria are a group of microorganisms that are found in plants, soil and water. Most of the bacteria are harmless but some of them can cause sickness and disease in humans. The most common of these are coliform bacteria which are present in intestines of warm blooded animals. It enters water when the water gets contaminated by animal feces and can cause diseases such as cramps, vomiting, diarrhea and intestinal infection.

## Minerals

Minerals are inorganic substances found in rocks and similar matter in the earth. Some minerals such as calcium, magnesium and potassium are considered good for humans and some such as lead, arsenic, and aluminum are considered harmful. Water is not a reliable source of minerals as it contains a mix of both types of minerals. The human body cannot absorb these minerals very well. The level of minerals dissolved in water determines its hardness.

## Particulates

Particulates are minute particles of dirt, sand, rust and sediment found in water. Particulates themselves do not adversely affect health but they are carriers of other harmful contaminants in water: organic, inorganic and microbiological. Particulates are measured in microns where one micron is one millionth of a meter.

## Chemicals

Chemicals contaminants can be natural or man-made. They enter water through pollution, industrial discharge, urban activities, agriculture and disposal of waste. These undesirable contaminants include toxic metal salts, nitrogen, bleach, pesticides, fertilizers, human and animal drugs.

The presence of these contaminants makes water treatment very important. These methods involve removal of contaminants from water to make it safe for human consumption without any risk of unfavorable effects on health.

Water treatment is done at two levels:

Community water treatment	Public drinking water systems use surface water treatment plants to provide safe drinking water to people.
Domestic water treatment	Individuals use home treatment units such as filters, water softeners and distillation systems to remove specific contaminants, to improve the taste of water and as precaution against disease.

*Fig. 3.2.3: Types of water treatment*

Water treatment methods use different types of agents to make water safe for drinking purpose. Water treatment agents can be divided into three categories as shown in the following figure:

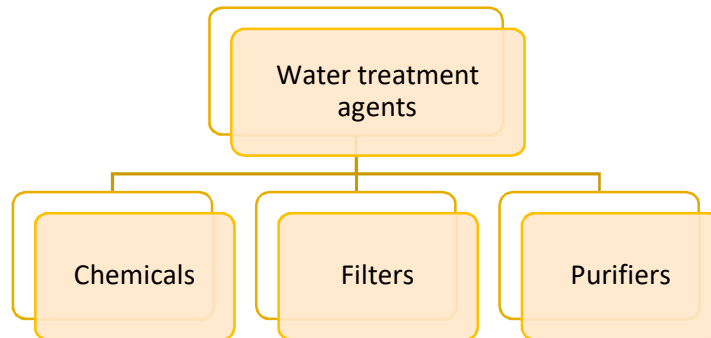


Fig 3.2.4: Water treatment agents

## Chemicals

A variety of chemicals are used in the process of water treatment for the purpose of desalination and stoppage of fouling and scaling. The three most commonly used chemicals are chlorine, chlorine dioxide and ozone. They are used as disinfectants to kill unwanted microorganisms present in water and improve the taste, odor and clarity of water.

## Filters

Filters purify water by removing impurities from it and reducing its contamination. The filtration process consists of making water flow over some type of filter which blocks the route of the contaminants. The filter can be a physical barrier, chemical process or a biological process. There are four main types of filters as shown in the following figure:

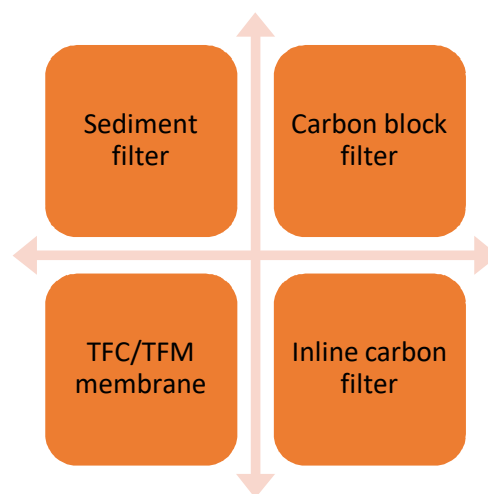
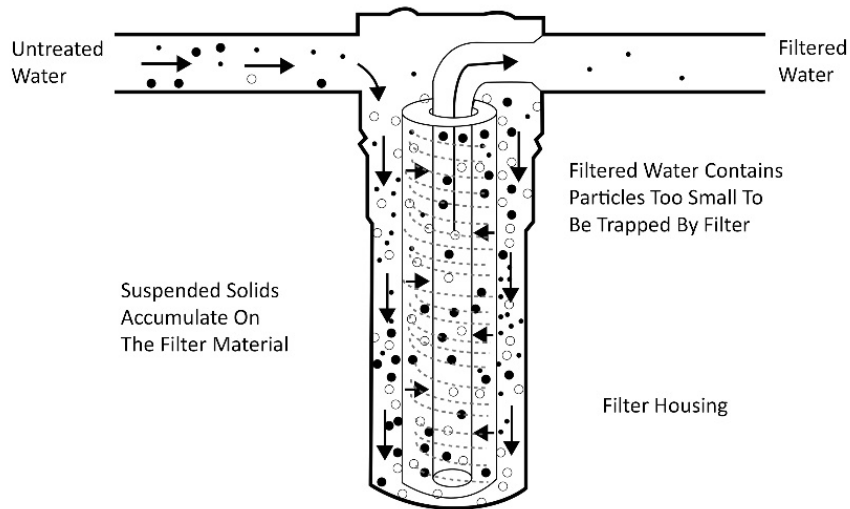


Fig. 3.2.5: Types of filters

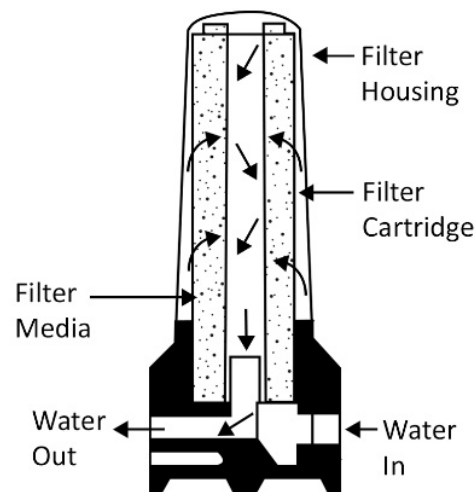
## Sediment Filter

Sediment filters remove suspended particulate matter such as sand, dirt, silt and organic matter from water. Water flows from the outside to the core of the filter and the impurities are retained on the filter surface. They, however, do not remove contaminants such as chlorine, lead, mercury and other organic compounds dissolved in water.



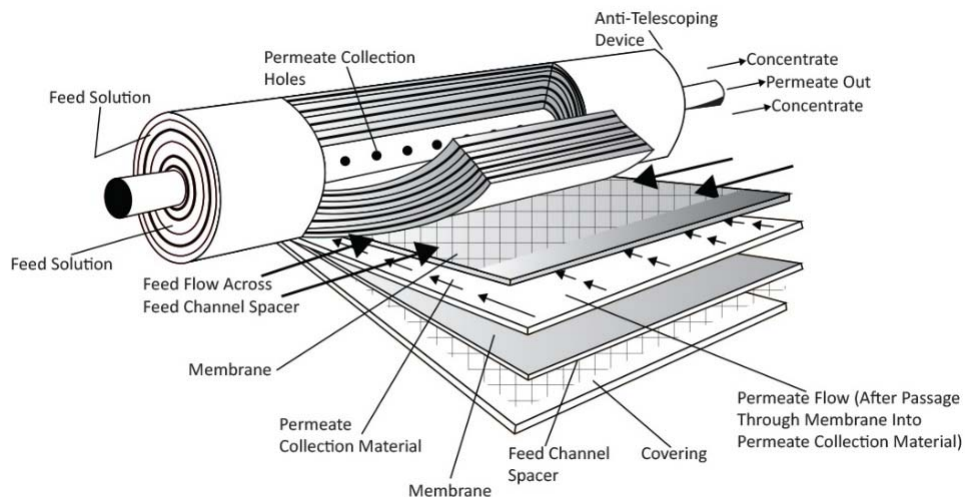
## Carbon Block Filter

Activated carbon block filters are used to remove contaminants such as chlorine, benzene, pesticides and other organic compounds. Carbon is activated by adding a positive charge which enhances the surface area as well as the ability of absorption of the filter.



## TFC/TFM Membrane

TFC/TFM are semi-permeable membranes used in the reverse osmosis (RO) water purification systems. Untreated water is forced through the membranes which act like a strainer and allow pure water to pass through leaving the dissolved contaminants behind.



## Inline Carbon Filter

Carbon filters can also be installed in-line as a part of the reverse osmosis water purification system. They are used as pre-treatment to safeguard other water treatment units, such as TFC/TFM membranes, from any damage due to organic fouling or oxidation.



## Purifiers

Water purifiers remove contaminants such as excess salts, suspended particles and microbes dissolved in water and preserve its necessary vitamins and minerals.

The difference between water filters and purifiers is the type of impurities removed by each one of them.

The following figure lists the main differences between the two:

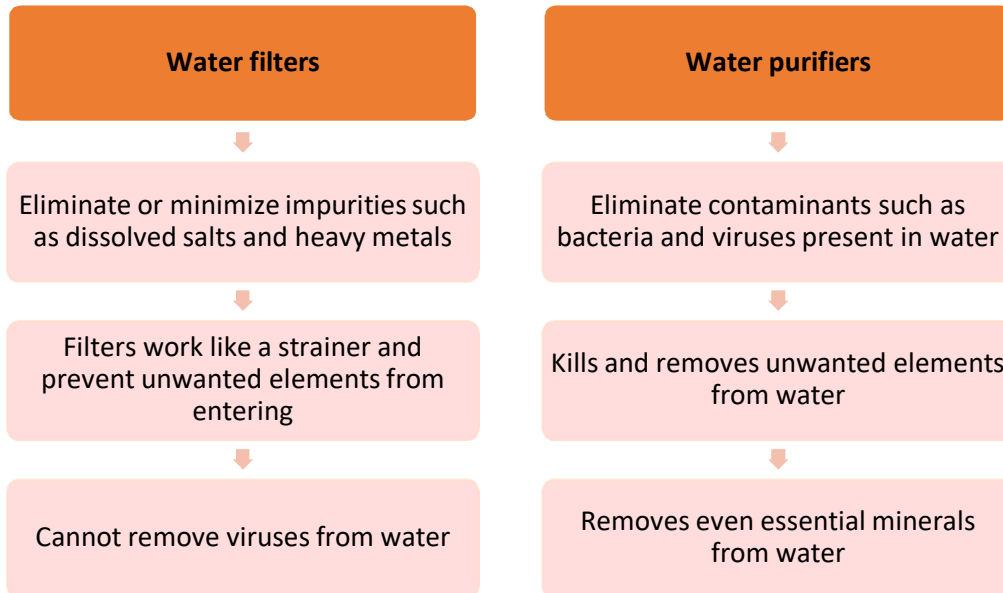


Fig. 3.2.6: Water Filters vs. Water Purifiers

### 3.2.3 Water Purification Process

Water purification is the process of removing contaminants from untreated or raw water to get pure water that is safe for consumption. It consists of three different processes as shown in the following figure:

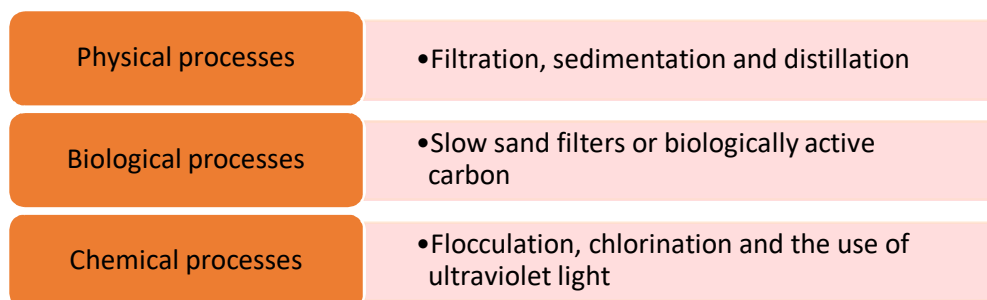


Fig. 3.2.7: Water purification processes

#### Steps of the Purification Process

The water purification process consists of four major steps as shown in the following figure:





*Fig. 3.2.8: Steps of water purification*

### **Coagulation**

When the water from ground, lakes, or river enters a water treatment plant, it is coagulated by the addition of alum and other chemicals. These sticky particles also known as floc, attract dirt particles which make them heavy and they sink to the bottom.

### **Sedimentation**

The water and floc pass into the sedimentation basin. The heavy floc settles down and the water is passed through filtration tanks.

### **Filtration**

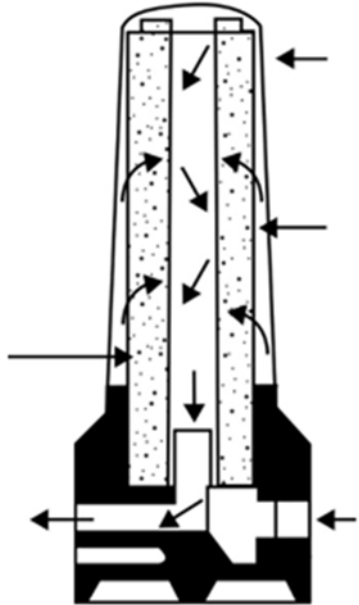
The filtration tanks consist of layers of gravel and sand which filter out the remaining contaminants.

### **Disinfection**

The water is passed into a closed reservoir containing disinfectants such as chlorine. These disinfectants kill the bacteria or microorganisms present in the water. The purified water then flows through pipes to homes.

### Activity: Identification Game

Label all the parts of standard carbon black filter in the following image.



## 4. Installing Water Purifiers



Unit 4.1 – Water Purifiers

Unit 4.2 – RO Water Purifiers

Unit 4.3 – Installing an RO Water Purifier



## Key Learning Outcomes



**At the end of this module, you will be able to:**

- Describe water purifiers
- List the different types of water purifiers
- Describe an RO water purifier
- Describe the functioning of RO water purifiers
- List the properties of RO water purifiers
- Describe the pre-installation process of RO water purifiers
- Install RO water purifiers
- Describe the post-installation process of RO water purifiers

## UNIT 4.1: Water Purifiers

### Unit Objectives

At the end of this unit, you will be able to:

- Explain water purifiers
- List the different types of water purifiers

### 4.1.1 Water Purifiers

Pure, clean and safe drinking water is a necessity for human life and health. Water that is supplied in homes is contaminated with organic and inorganic particles. It becomes critical to purify the tap water to ensure it is safe for consumption and does not have any adverse effect on health. A water purifier removes contaminants such as excess salts, suspended particles and microbes dissolved in water and preserve its necessary vitamins and minerals. The following image shows a common water purifier:



Fig. 4.1.1: A water purifier

### 4.1.2 Types of Water Purifier

There are five major categories of water purifiers, depending on the purification methods they use. The following figure lists these categories:

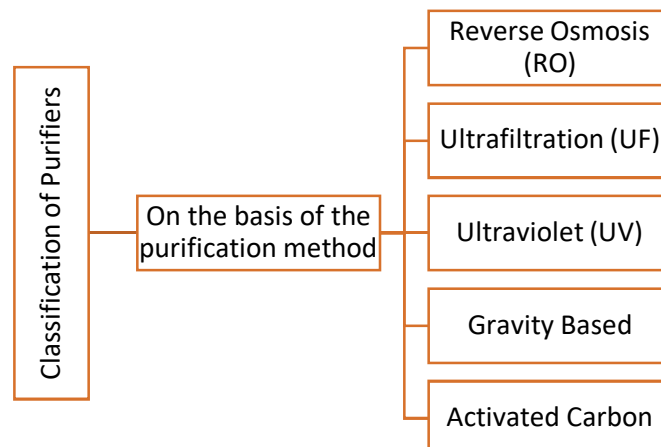


Fig. 4.1.2: Types of purifiers

## RO Water Purifiers

RO water purifiers are the most commonly used purifiers and are based on the principle of reverse osmosis. They make use of the membrane technology to eliminate contaminants such as salts, heavy metals and germs dissolved in water. The following image shows an RO purifier membrane:

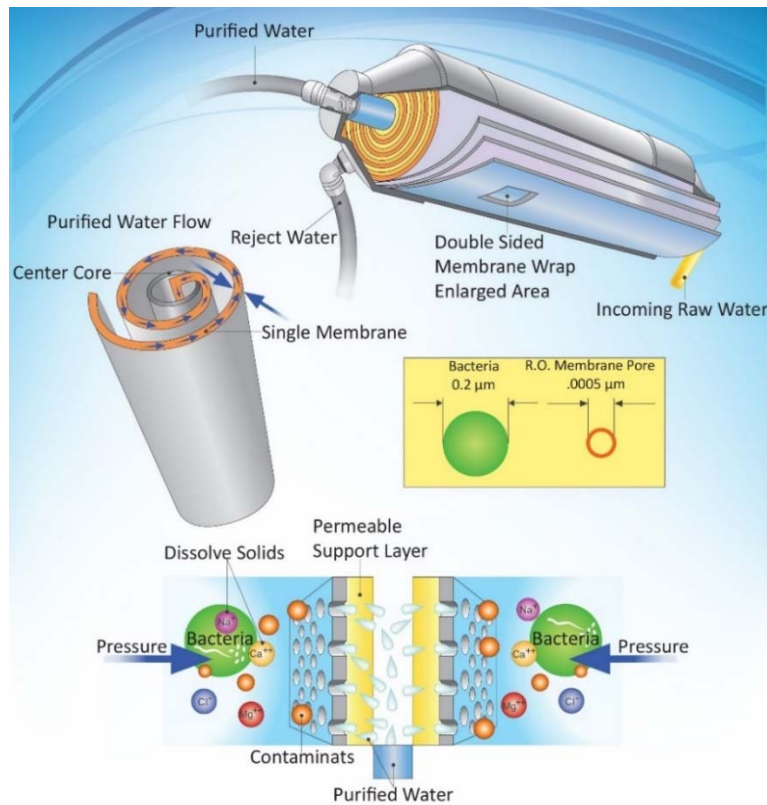


Fig. 4.1.3: An RO purifier membrane

The main advantages of using an RO purifier are as shown in the following figure:

Removes impurities such as lead, arsenic, mercury and germs from water

Environmental friendly

Suitable for hard water

Suitable for water with high total dissolved salts (TDS)

Easy to install and maintain

Fig. 4.1.4: Advantages of an RO purifier

There are certain disadvantages of an RO purifier such as:

- Removes essential minerals along with dissolved impurities
- Alters the taste of water
- Wastes large quantity of water
- Requires electricity to purify water
- Requires special care and maintenance for its membrane

## UF Water Purifiers

UF water purifiers use membranes similar to an RO membrane but with larger pores. They remove all germs and bacteria from water but do not remove dissolved salts or solids. They are suitable in homes where the water supplied is not very hard and has less dissolved salts. The process of purification in a UF purifier is shown in the following image:

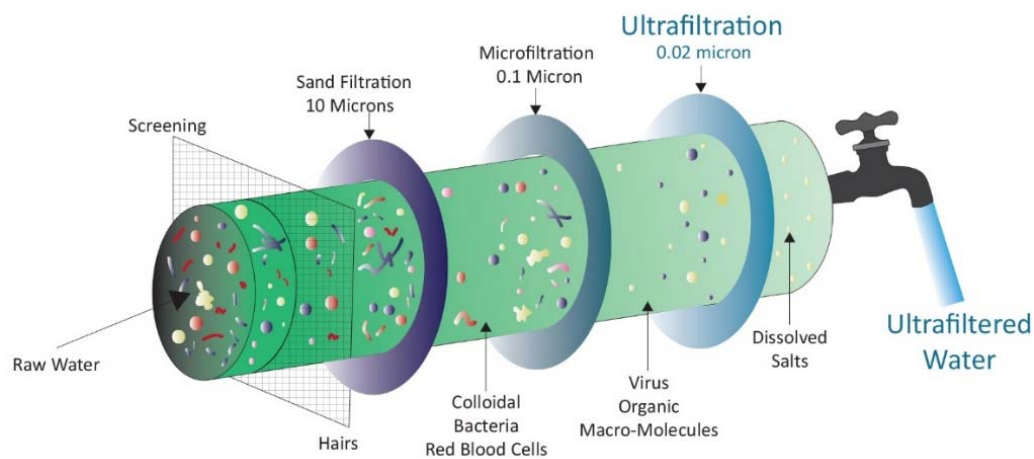


Fig. 4.1.5: Process of purification in a UF purifier

The main advantages of using a UF purifier are as shown in the following figure:

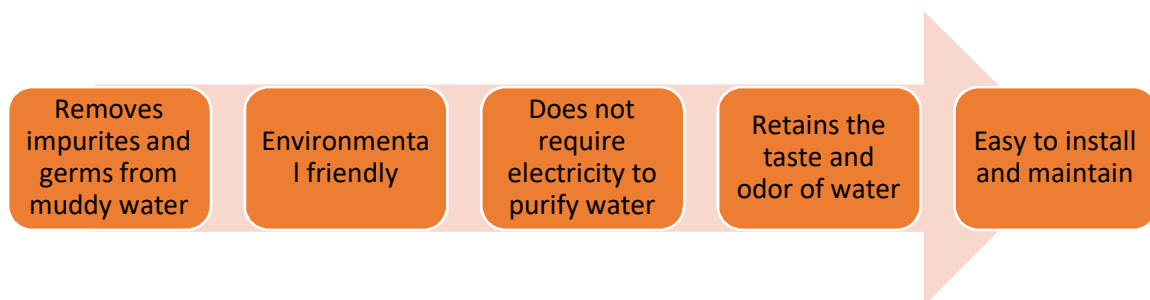


Fig 4.1.6: Advantages of a UF purifier

There are certain disadvantages of a UF purifier such as:

- Unable to remove dissolved impurities such as arsenic, lead, nitrates and fluorides
- Ineffective as compared to an RO water purifier as it cannot block dissolved salts and solids
- Good only for water with low TDS

## UV Water Purifiers

UV water purifiers use ultraviolet rays to kill all germs, bacteria and microbes dissolved in water. A small mercury lamp is placed inside the purifier, which produces high frequency short wave UV radiations. When water passes through this element, it is exposed to the UV light which kills all the living organisms.

Separate filters then remove the dead germs.

UV purifiers are used in residences, breweries, water stores, restaurants and municipalities.

The following image shows the working of UV water purifiers:

The main advantages of using a UV purifier are as shown in the following figure:



*Fig 4.1.7: Advantages of a UV purifier*

There are certain disadvantages of a UV purifier such as:

- Unable to remove dissolved impurities such as arsenic, lead, nitrates and fluorides
- Requires electricity to purify water

## Gravity Based Water Purifiers

Gravity based water purifiers are based on the principle of gravity. The water flows from a higher compartment over the filters to a lower compartment. They do not require electricity and use either chemical based, UF based or ceramic cartridge based filters to purify water.



The following figure shows the parts of a gravity based purifier:

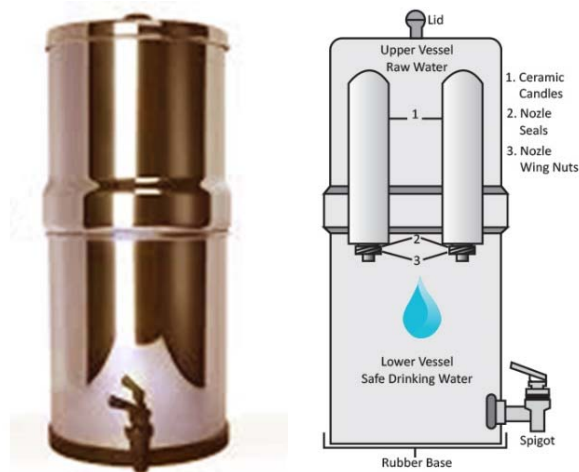


Fig. 4.1.8: A gravity based purifier

The main advantages of using a gravity based purifier are as shown in the following figure:

Removes impurities and germs from muddy water

Environmental friendly

Does not require electricity to purify water

Suitable for soft water

Portable and easy to install

Fig. 4.1.9: Advantages of a gravity based purifier

There are certain disadvantages of a gravity based purifier such as:

- Unable to remove dissolved impurities such as arsenic, lead, nitrates and fluorides
- Ineffective as compared to an RO water purifier as it cannot block dissolved salts and solids
- Good only for water with low TDS

### Activated Carbon Water Purifiers

Activated carbon is carbon with a positive charge added to it. When water flows over it, the negative ions of contaminants get attracted to the surface of the activated carbon filter. Activated carbon water purifiers can remove volatile organic compounds, pesticides, herbicides, chlorine and other chemicals found in tap water. This makes the water safe to drink.

The following images shows the process of purification in an activated carbon water purifier:



*Fig 4.1.10: An activated carbon block filter*

The main advantages of using an activated carbon purifier are as shown in the following figure:

Removes volatile organic chemicals, radon and chlorine

Environmental friendly

Eliminates bad odor and taste

Cost effective

Does not require electricity to purify water

*Fig. 4.1.11: Advantages of an activated carbon purifier*

There are certain disadvantages of an activated carbon purifier such as:

- Unable to remove dissolved microbes and impurities such as arsenic, lead, nitrates and fluoride
- Ineffective as compared to an RO water filter as it cannot block dissolved salts and solids
- Requires frequent filter changes

**Activity: Identification Game**

Match the following.

1. Gravity Based Water Purifiers	a. Removes impurities such as lead, arsenic, mercury and germs from water
2. UV Water Purifiers	b. Removes volatile organic chemicals, radon and chlorine
3. RO Water Purifiers	c. Removes viruses, bacteria and germs from water
4. Activated Carbon Water Purifiers	d. Removes impurities and germs from muddy water

## UNIT 4.2: RO Water Purifiers

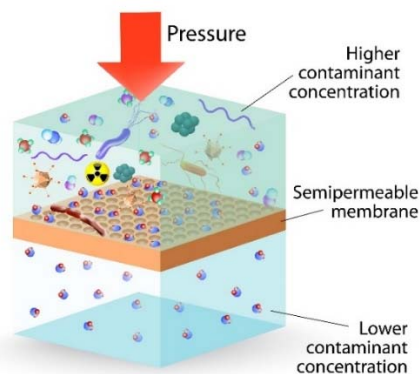
### Unit Objectives

**At the end of this unit, you will be able to:**

- Describe an RO water purifier
- List the properties of RO water purifiers
- List the components of RO water purifiers
- Describe the functioning of RO water purifiers

### 4.2.1 RO Water Purifier

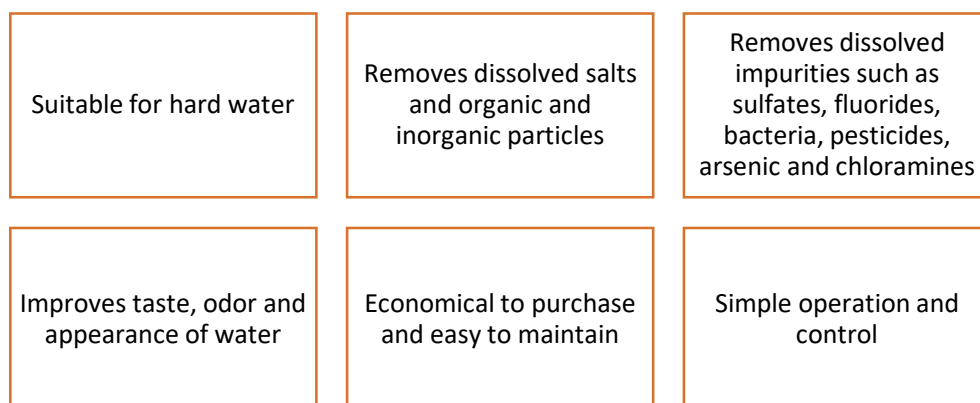
RO water purifiers work on the principle of Reverse Osmosis (RO). In this process, pressure is applied on contaminated water to force it through a semi-permeable membrane. The water is purified by filtering and flushing out the impurities as shown in the following image:



*Fig. 4.2.1: Reverse osmosis process*

### 4.2.2 Properties of RO Water Purifier

The properties of an RO water purifier are shown in the following figure:



*Fig. 4.2.2: Properties of an RO water purifier*

### 4.2.3 Component of RO Water Purifier

The following figure lists the basic components of an RO system:

Supply line valve	Attaches the inlet of the RO pre-filter to the water source through a tube
Pre-filter - Sediment	Removes sand, dirt and other sediments
Carbon filter	Adsorbs chemical impurities such as chlorine and pesticides and improves odor and taste of water
RO membrane	Removes almost all dissolved salts, impurities and bacteria
Water tank	Stores water before 'post filtration'
Post filter	Also known as 'polishing' filter as it removes the remaining taste and odor from the treated water
Shut-off valve	Automatically shuts-off the water supply to the membrane when the storage tank gets full
Check valve	Prevents backward flow of water from the tank to the membrane
Flow restrictor	Maintains pressure on the inlet of the membrane to ensure the highest quality of water
Drain line	Connects one outlet of the membrane to the drain to dispose off waste water

*Fig. 4.2.3: Components of an RO water purifier*

## 4.2.4 Functioning of RO Water Purifier

The following figure explains the steps involved in the functioning of an RO water purifier:

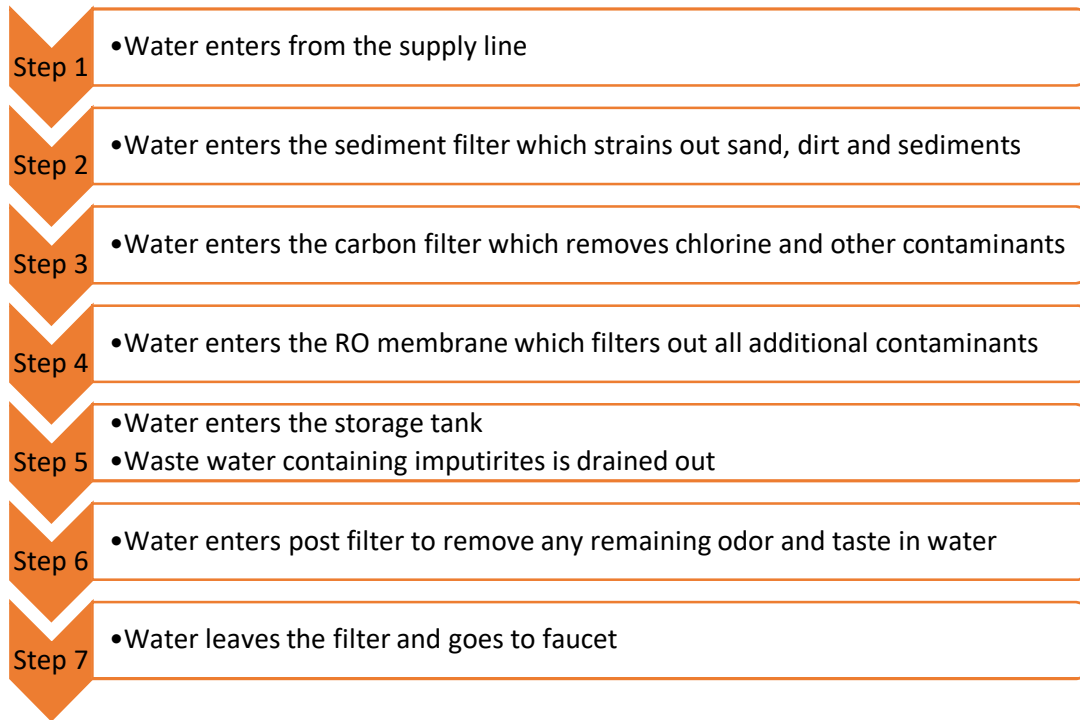


Fig 4.2.4: Functioning of an RO water purifier

The following diagram shows the flow of water in an RO purifier:

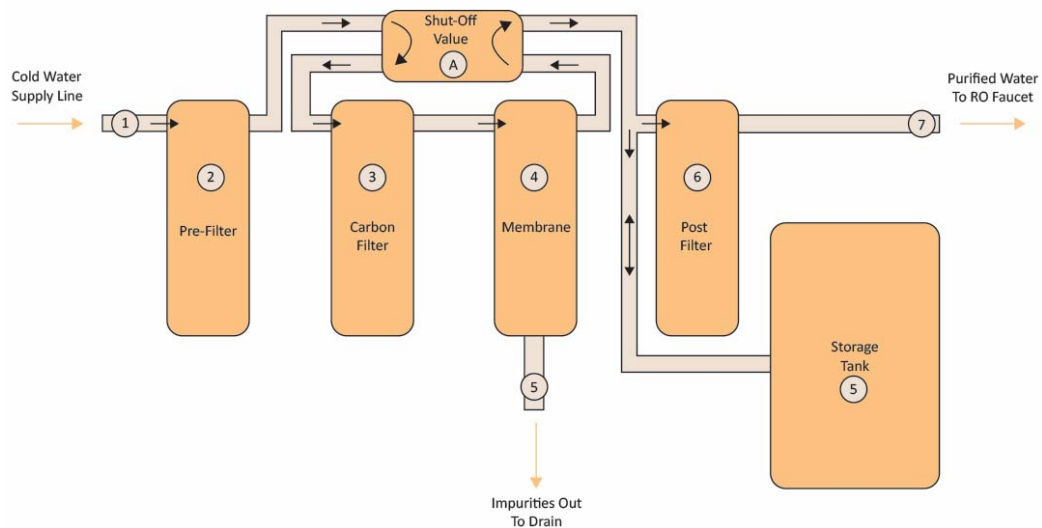
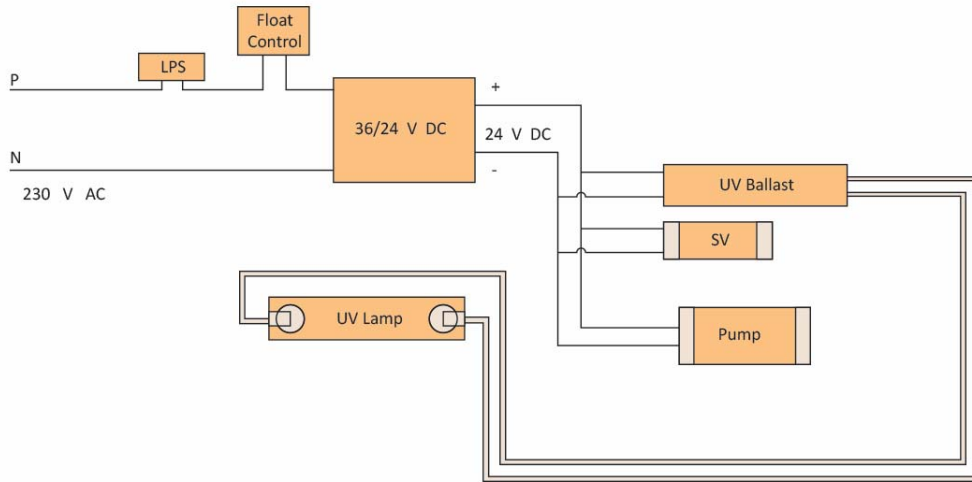


Fig. 4.2.5: Water flow in an RO water purifier

The following diagram shows the flow of electric current in an RO purifier:



*Fig. 4.2.6 Electrical circuit diagram of an RO Water Purifier*

**Activity: Role Play** 

A customer asked you to tell the components of RO Water Purifier. List all the components that you will tell him.



## UNIT 4.3: Installing an RO Water Purifier

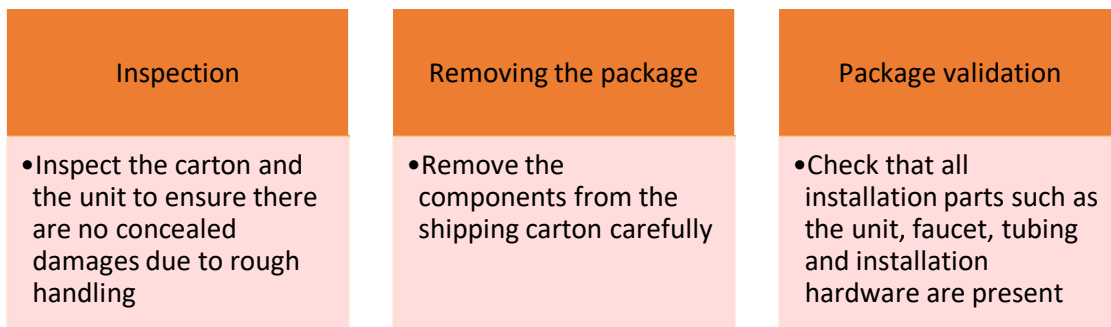
### Unit Objectives

**At the end of this unit, you will be able to:**

- Describe the pre-installation process of RO water purifiers
- Install RO water purifiers
- Describe the post-installation process of RO water purifiers

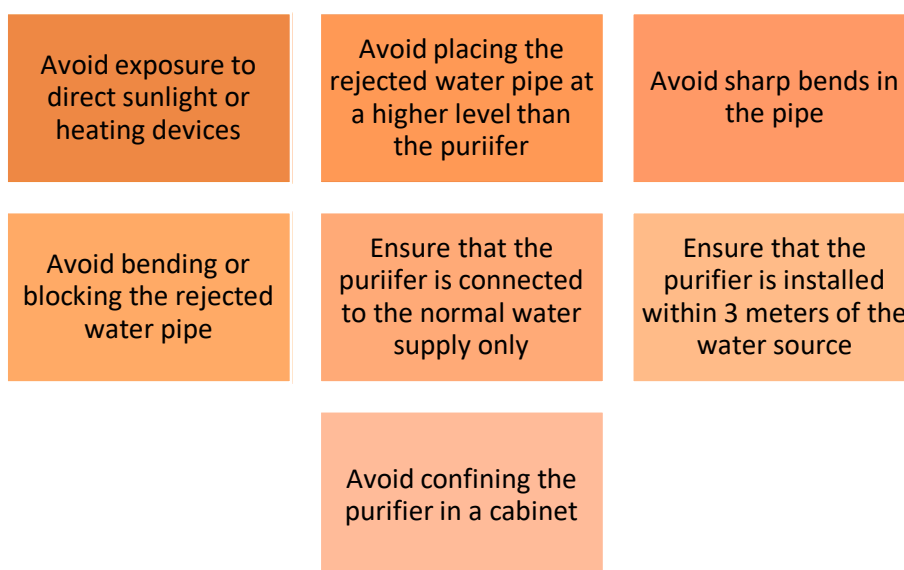
### 4.3.1 Pre-installation Process of Water Purifiers

Before beginning the installation, the pre-installation process should be followed to ensure that the unit is properly installed. The pre-installation checks consist of tasks as shown in the following figure:



*Fig. 4.3.1: Pre-installation process of RO water purifiers*

The following figure lists the guidelines that should be followed before installing an RO water purifier:



*Fig. 4.3.2: Pre-installation guidelines*

### 4.3.2 Installation of RO Water Purifiers

The installation process begins with site preparation. The recommended site preparation steps are shown in the following figure:

Ensure single phase connection is within 3m of the point of installation

Ensure raw water supply is within 3m

Ensure raw water supply tank is at least 10 feet above the purifier

Ensure there is a sink near the purifier

Ensure waste water drain is within 3m

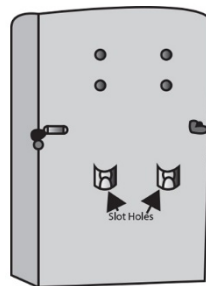
Ensure enough space is there as per the dimensions of the purifier

*Fig. 4.3.3: Site preparation steps*

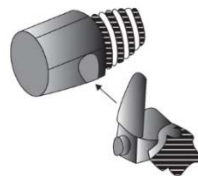
### Installation Procedure

The following steps should be performed when installing a wall mounted RO water purifier:

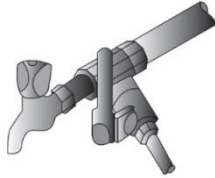
1. Disconnect the water supply line from the normal tap water.
2. Mark screw locations at same horizontal level on the wall.
3. Screw in two self-taping screws into the marked positions.
4. Hang the purifier with the help of wall mounting screws present at the back of the purifier.



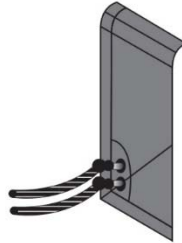
5. Fix the SS ball valve to the port of 3-way connector.



6. Connect the raw water supply to the 3-way connector:
  - a. Connect the threaded end of the connector to the raw water supply.
  - b. Connect the other end to a tap, if required.



7. The left side of the purifier has a lower pushfit elbow fitting labeled as WATER IN.
8. Take the white pipe which is for raw water supply:
  - a. Connect one end to the SS ball valve.
  - b. Connect the other end to the WATER IN fitting.



9. The left side of the purifier has an upper pushfit elbow fitting labeled as REJECT WATER.
10. Take the blue pipe which is for reject water:
  - a. Connect one end to the REJECT WATER fitting.
  - b. Leave the other end in the drain.



11. Open the SS ball to start the flow of water into the purifier.
12. Ensure that the filters are soaked in water before connecting the power supply.

### 4.3.3 Post-installation Process of RO Water Purifiers

Once the purifier has been successfully installed, it is time to follow the post-installation process to ensure completion of the installation process. The post-installation process consists of tasks as shown in the following figure:

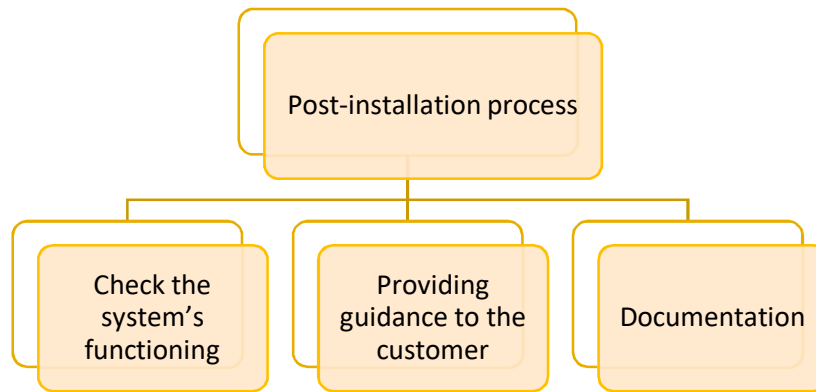


Fig. 4.3.4: The post-installation process

#### Check the System's Functioning

Perform the checks as shown in the following figure to ensure that the purifier is working properly:

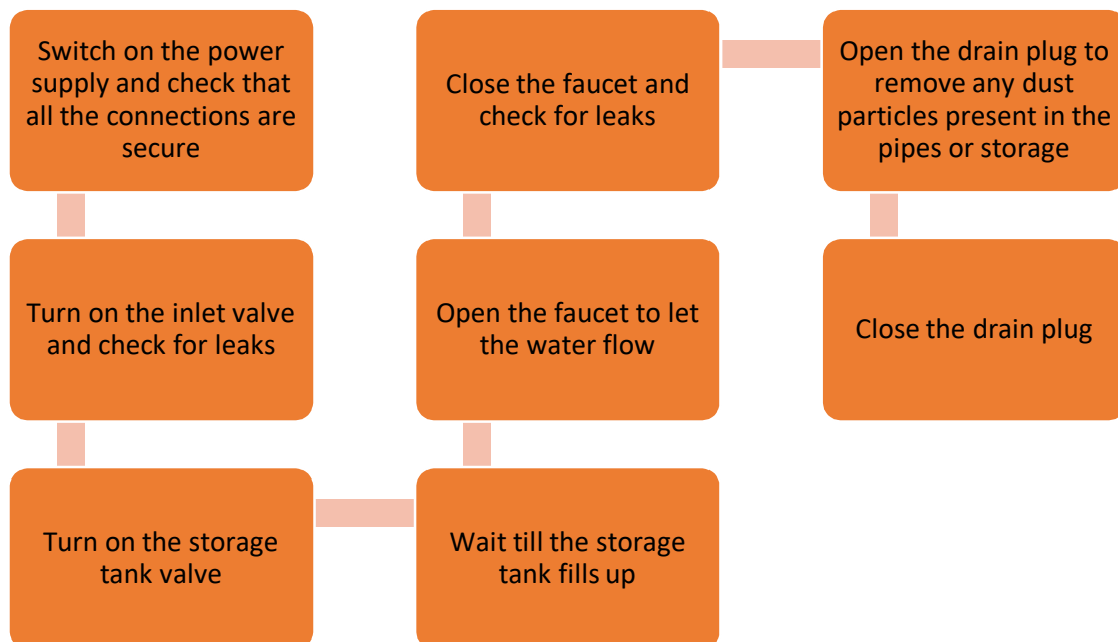


Fig. 4.3.5: Checks to ensure proper working of an RO purifier

## Providing Guidance to the Customer

After installing the purifier, the field technician should give a demonstration of the working of the purifier. It is a way of promoting or showing the operation of purifier to the users. The goal of demonstrating is to show the customer how to operate and use the purifier. There are a few rules which must be considered while preparing for the demo. The following figure lists these rules:

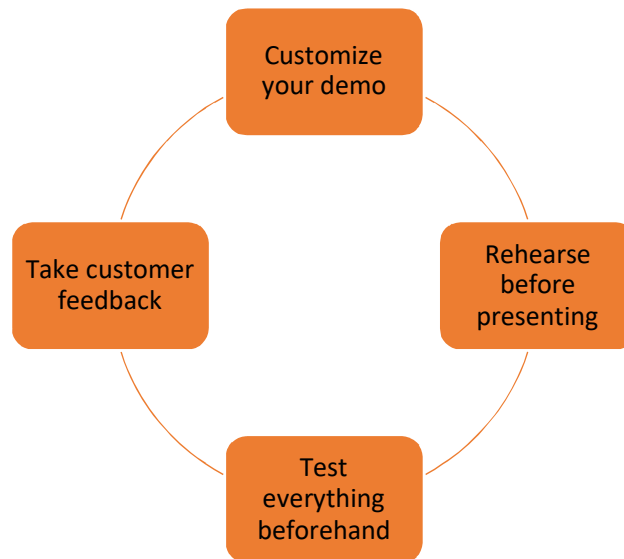


Fig. 4.3.6 Rules for an effective demo

## Documentation

The last task of the post-installation process is to fill in all the details in the installation report clearly and get feedback from the customer. The following image shows a typical template of the installation form that the field technician should fill-in after installing an RO system:

Installation Report	
Product :	Invoice No. _____
Serial No.	Invoice Date _____
Customer's Name _____	Installation Date _____
Customer's Address _____	Service Provider's Name: _____
_____	Service Provider's Address _____
Customer's Ph. _____	_____
TDS Of Purified Water _____	Service Provider's Ph. _____
Customer's Signature _____	TDS of Raw Water _____
	Service Provider's Stamp _____
By Signing On This Installation Report, The Customer hereby Agrees To The Terms & Conditions Of Warranty Mentioned On The Back Side Of The Warranty Card.	

Fig. 4.3.7: A sample installation report

**Activity: Role Play**



Install a RO Water Purifier.



## 5. Repairing RO Water Purifiers

Unit 5.1 – Understanding Customer Complaints

Unit 5.2 – Maintenance and Troubleshooting of  
RO Water Purifiers

Unit 5.3 – Safety rules



## Key Learning Outcomes

**At the end of this module, you will be able to:**

- Inspect, diagnose and identify customer issues
- Test the proper working of purifier
- Perform maintenance of RO Water Purifiers
- Repair water purifiers
- Troubleshoot frequently occurring problems and provide solution
- List the safety rules



## UNIT 5.1: Understanding Customer Complaints

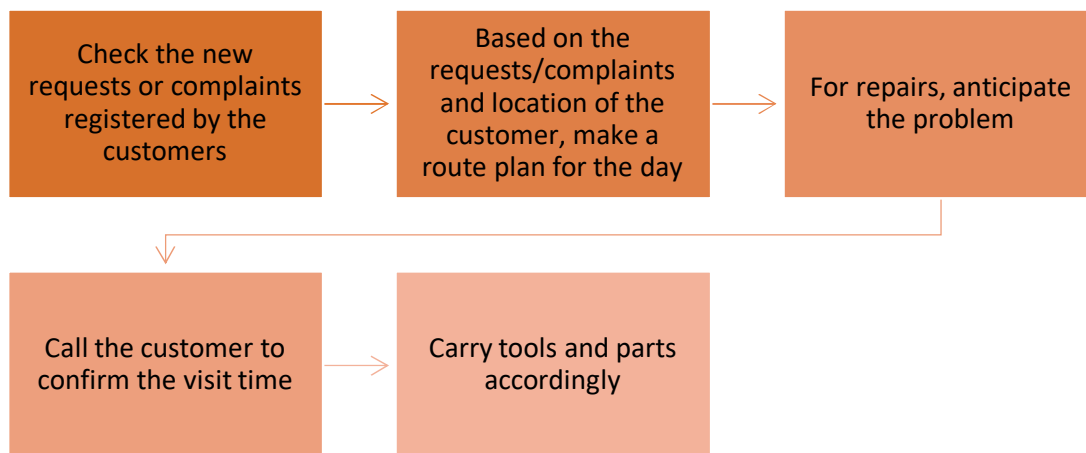
### Unit Objectives

**At the end of this unit, you will be able to:**

- Inspect and communicate the issue
- Diagnose and Identify the issue
- Explain the solution
- Test the proper working of purifier
- List the dos and don'ts
- Perform documentation

### 5.1.1 Identify the Concerns of the Customers

A field technician is responsible for the maintenance and repair of RO systems installed at customer's premises. It is very important for him to clearly understand the concerns of the customer. The following figure represents the various activities which should be done before scheduling a visit to the customers' premises:



*Fig 5.1.1: To-do list for a technician*

### Interact with the Customers on Phone

Prior to visiting a customer's premises for repairing/servicing, it is important to call the customer and ask about the problem in detail.

The following figure highlights the to-do list to be followed when on a call with a customer before visiting the premises:

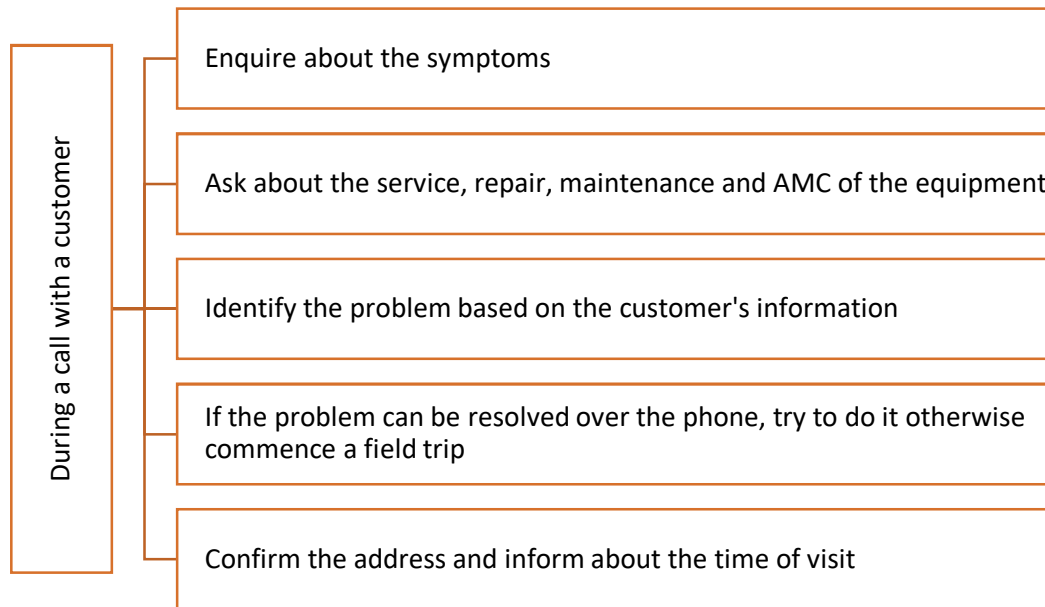


Fig 5.1.2: Interacting with customer on Phone

## Interact with the Customer at their Premises

It is a good practice to be humble and respectful towards the customer. The following figure represents how to interact with a customer when visiting the premises for service/repair:

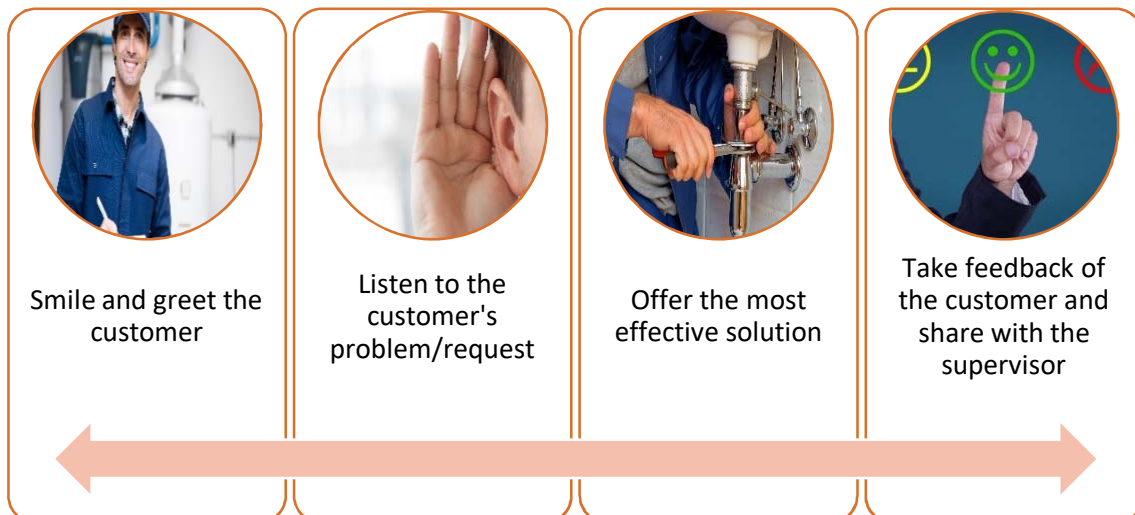
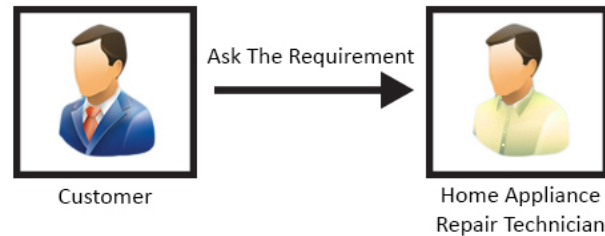


Fig 5.1.3: Interacting with customer



## 5.1.2 Understand the Symptoms and Identify the Fault

It is very important for a technician to identify the fault correctly. Wrong identification of fault will lead to wrong solution which will be waste of time and money and can also cause damage to the appliance.



When visiting a customer for a repair/servicing request, it is important to know the details of the problem and accordingly suggest a corrective measure. The customer should be satisfied with the suggested solution. The following figure highlights the to-do list to be followed at a customer's premises:

At customer's premises	Enquire about the symptoms and history of problem
	Ask about the year of purchase, service and warranty
	Identify the problem based on customer's information and examination
	Communicate the problem identified to the customer and inform about possible reasons
	Inform the customer regarding the costs involved and hand over the invoice after task is completed
	Ensure service is provided to achieve 100% customer satisfaction

*Fig 5.1.4: To-do list to be followed at a customer's premises*

## 5.1.3 Suggest a Solution to the Customer

After identifying the issue, the field technician needs to offer solutions. He should explain all the possible solutions along with the cost associated. He should then propose the best solution and let the customer decide whether to go ahead with the given solution or not.

The following figure shows the steps involved in offering solutions to a customer:

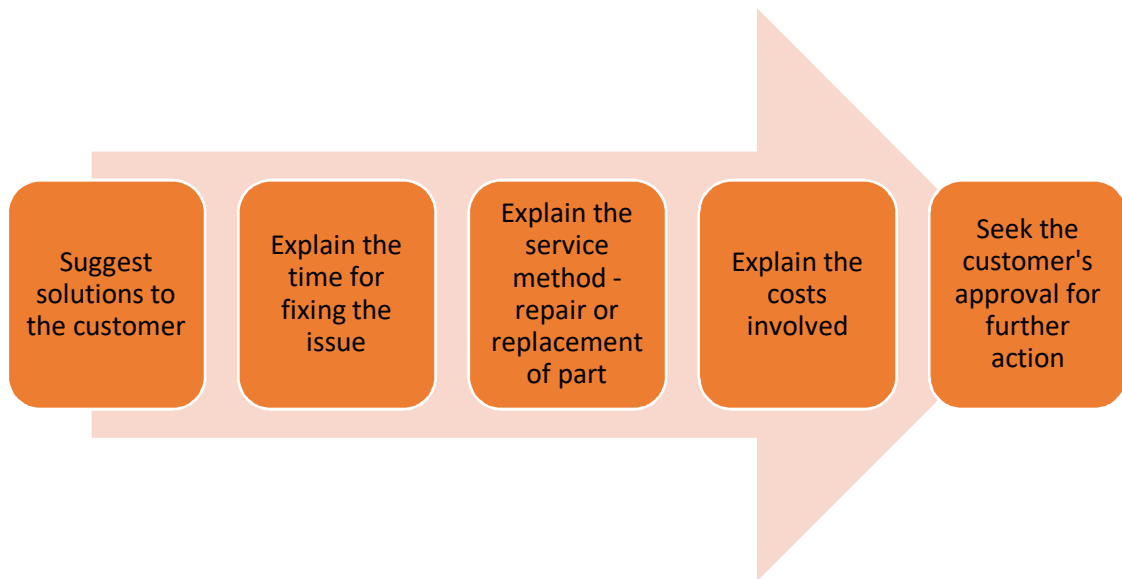


Fig 5.1.5: Suggesting a solution to the customer for an issue

## Confirmation of Functionality of the Repaired Module

Once the purifier has been repaired, ensure that the unit is functioning properly with the repaired or replaced parts. The following figure lists the checks that should be performed after repairs are complete:

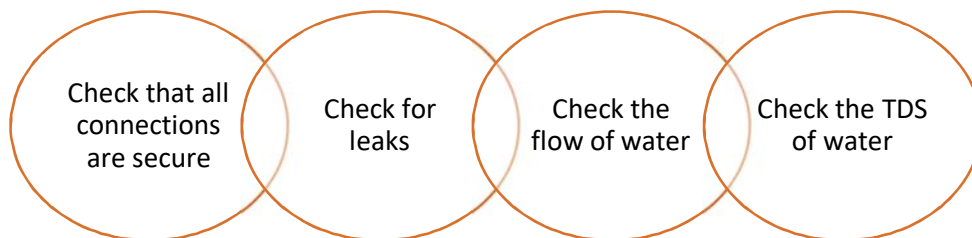


Fig 5.1.6: Checks performed after repairs

## Take Feedback from Customer

The last step of understanding customer's concerns is to take feedback from the customer as this is the most important thing for an organization. The procedure as shown in the following figure should be followed:

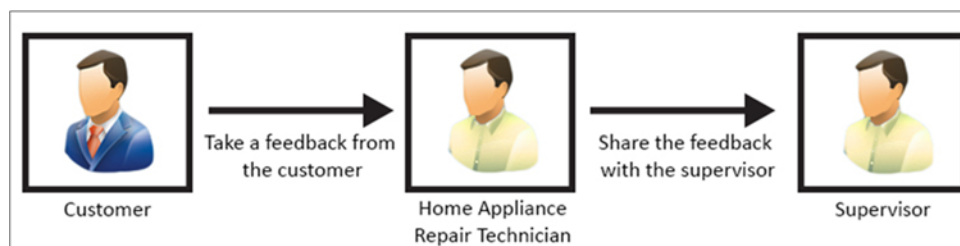


Fig. 5.1.7: Procedure to be followed for taking customer feedback

The time taken to resolve an issue and the difficulties that a customer encountered while communicating the problem should be understood. The misunderstandings observed during the interaction should be clearly documented.

The methods of interaction and behavioral aspects also need to be considered in drawing conclusions after each task or problem handling routine. Getting honest feedback from the clients helps to improve the organizational functioning.

The field technician can get a feedback form filled by the customer at the facility. The following figure shows a typical template for a customer feedback form:

## Customer Feedback Form

*Please fill the form. We value your feedback.*

Date: \_\_\_\_\_ Location: \_\_\_\_\_

Service:            Complaint                        New Connection           

1. How would you rate our service?

           Very Good

           Good

           Poor

2. Did the technician come with all the necessary tools and equipment to do the job?

           Yes                        No

3. Did the technician behave politely with you?

           Yes                        No

4. Did the wireman have knowledge of the work to be done?

           Yes                        No

5. Any suggestion which you would like to share.

*Fig. 5.1.8: A sample customer feedback form*

**Activity: Role Play** 

You are a home appliance repair technician. You just received a phone call from customer who is very angry for a poor service done by one of your colleague. He's threatening to charge you of the bad service instead of him. How should the situation be handled?

## UNIT 5.2: Maintenance and Troubleshooting of RO Water Purifiers

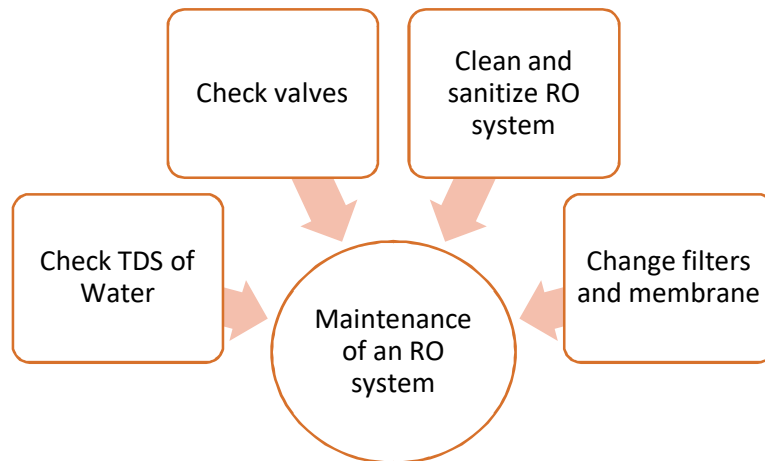
### Unit Objectives

**At the end of this unit, you will be able to:**

- Perform maintenance of RO Water Purifiers
- List the frequently occurring problems
- Troubleshoot and provide solution to the problems

### 5.2.1 Maintenance of RO Water Purifiers

To ensure that the water purifier provides the same quality water, it is essential to do periodic maintenance of the system. The following figure lists the components of the maintenance of an RO system:



*Fig 5.2.1: Maintenance of an RO system*

#### Check TDS of Water

Water is often called the universal solvent because it picks up impurities easily. The impurities can be minerals, salts, metals or ions and are also known as 'Dissolved solids'. These dissolved solids increase the electrical conductivity of water. TDS is used as a measure to determine the purity of water and the quality of water purification systems.

#### Total Dissolved Solids (TDS)

Total Dissolved Solids (TDS) are the total amount of dissolved solids present in water. It is the sum of positively charged ions (cations) and negatively charged ions (anions) in the water. It is measured in units of mg per unit volume of water (mg/L) and is also referred to as parts per million (ppm).



The maximum contamination level advised for TDS is 500 mg /L and a high level of TDS indicate the possibility of toxic ions such as lead, arsenic, cadmium and others dissolved in water. The following figure shows the various levels of TDS in water:

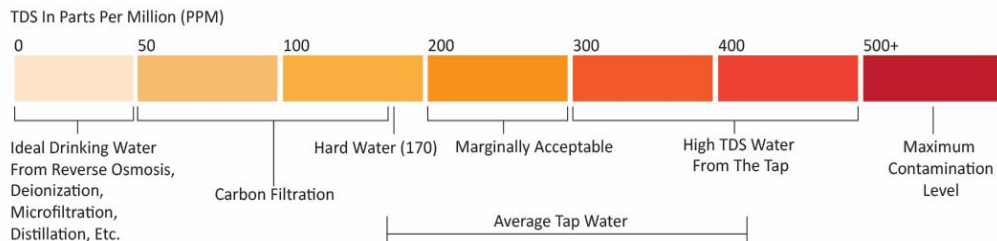


Fig 5.2.2: Levels of TDS in water

It is important to monitor the TDS regularly to ensure that the water purification system is effective in removing unwanted particles from water.

The following figure lists the reasons for testing water for high TDS:

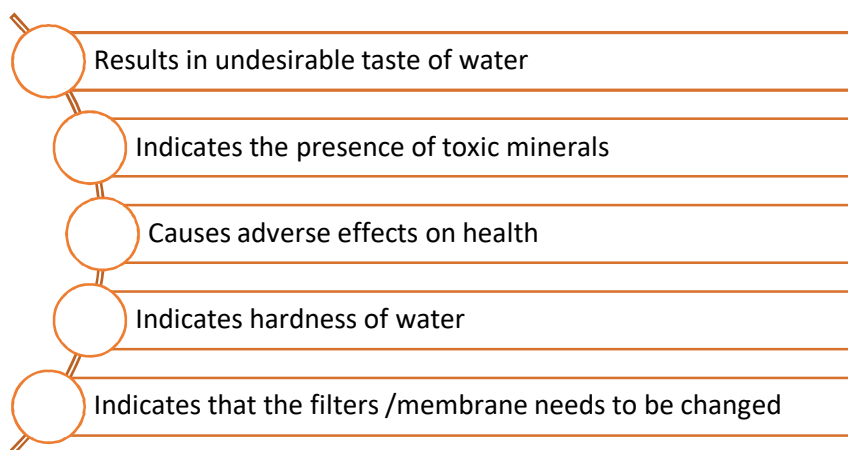


Fig 5.2.3: Reasons for testing water for high TDS

### TDS Meter

TDS of water or any solution is measured with the help of TDS meter. It is a small hand held device that measures the electrical conductivity of water and estimates the TDS from that reading. The following figure shows a commonly used TDS meter:

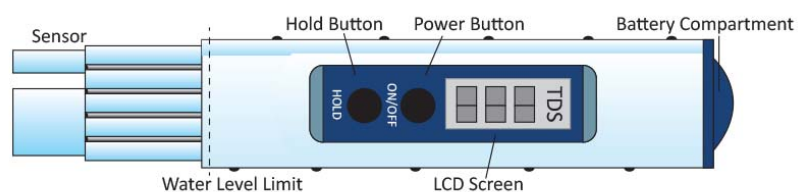
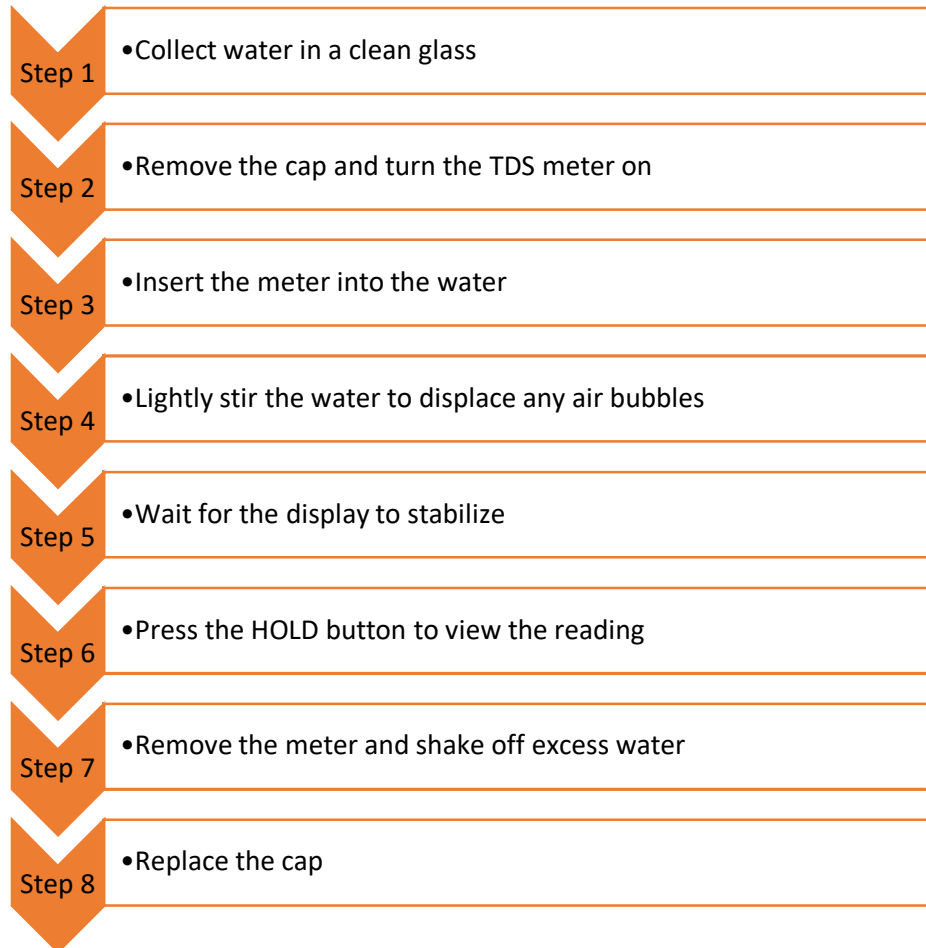


Fig 5.2.4: TDS meter

## Taking TDS Measurements

A TDS meter is very easy and simple to use. The following figure lists the steps of taking TDS measurements using a TDS meter:



*Fig 5.2.5: Using a TDS meter*

## Check valves

An RO system has two types of valves – Auto-shut-off valve (ASV) and check valve (CV). If either of the two is defective then the RO system will not shut-off and the water will be running constantly.

The following figure lists the steps involved in checking auto-shut-off valve and check valve:

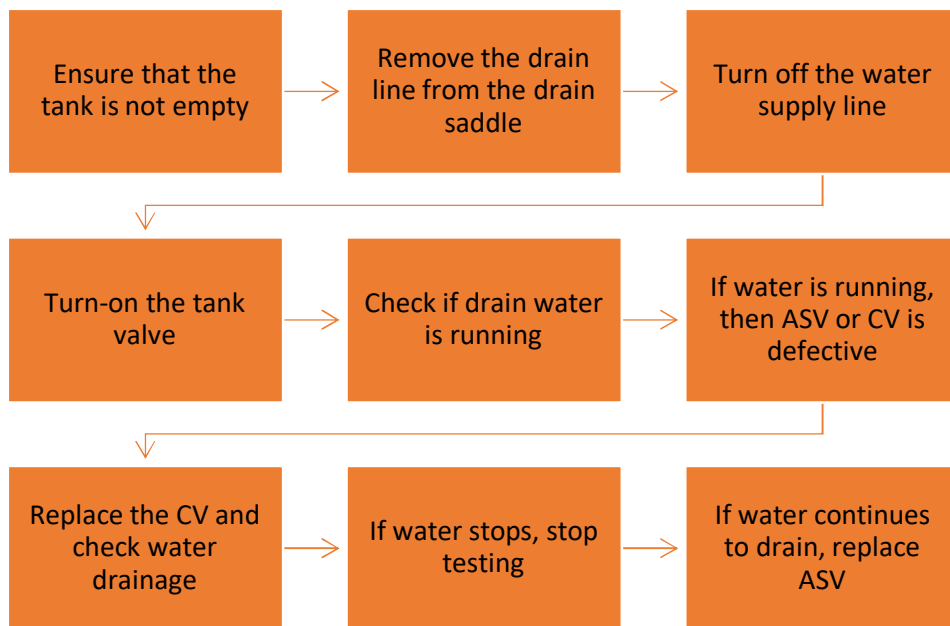


Fig 5.2.6: Steps to check valves of an RO system

## Clean and Sanitize RO System

An RO system should be cleaned and sanitized at least once every year. The steps to sanitize an RO system are listed in the following figure:



Fig 5.2.7: Steps to sanitize an RO system

## Changing Filters and Membrane

It is recommended to change the filters/membrane of an RO system as per the following schedule:

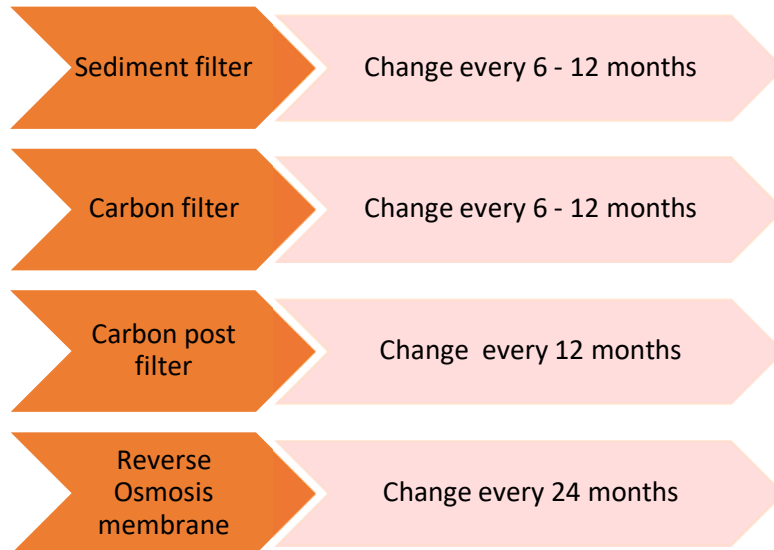


Fig 5.2.8: Filter change schedule

When changing filters or membrane of the system, it is vital to follow appropriate sanitation and service procedures as outlined in the following figure:

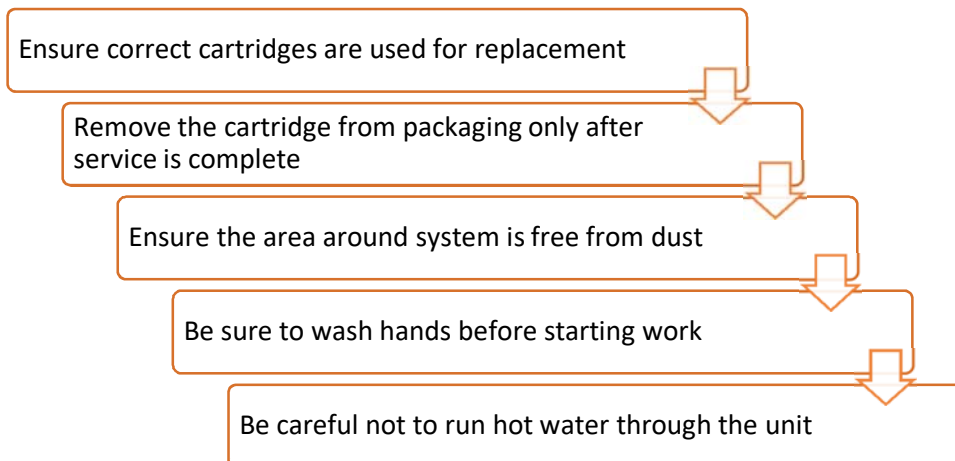


Fig 5.2.9: Sanitation and service procedures

## Changing filter

The following figure lists the steps involved in changing the filter:

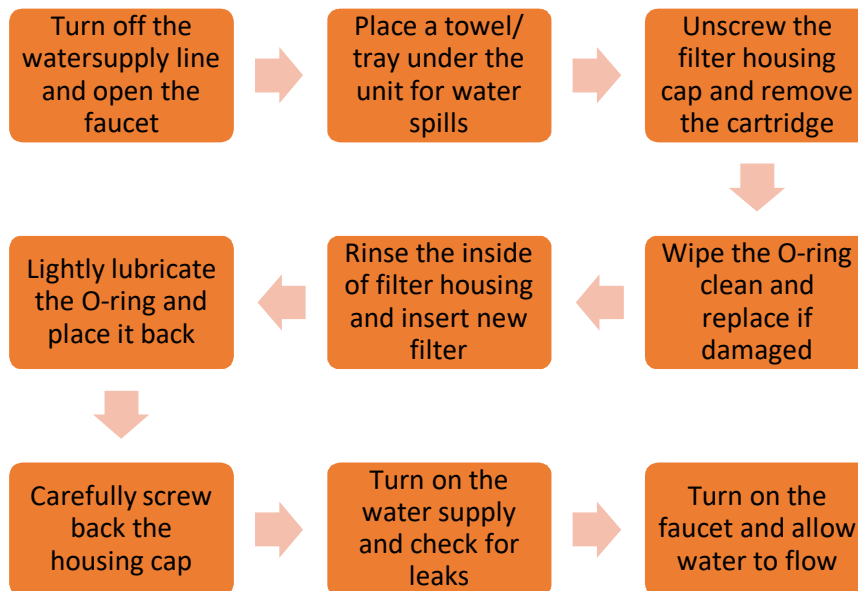


Fig 5.2.10: Steps of changing the filter

## Changing Membrane

The following figure explains the steps involved in changing the membrane:

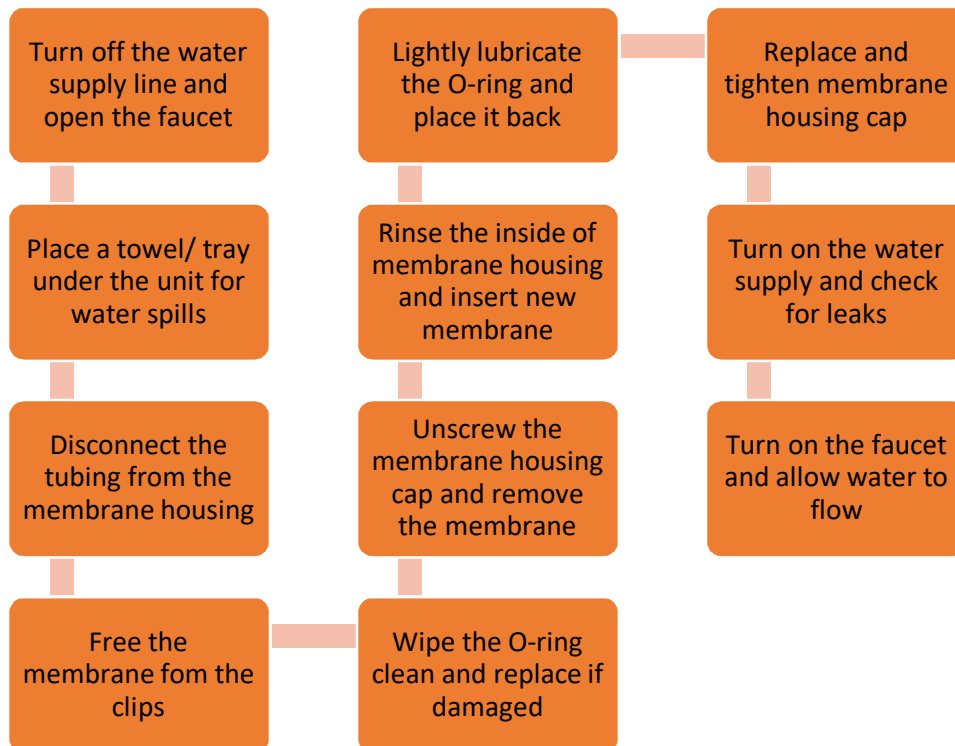


Fig 5.2.11: Steps of changing the membrane

## Inform the Customer about the Dos and Don'ts of Maintenance

Inform the customers that an RO water purifier lasts for many years if it is maintained properly. The following figure shows the various Dos and Don'ts that should be followed:

Do not place heavy or sharp objects on the purifier

Drain the water from the tank if it has not been used for over 2 days

Do not apply force on the water dispensing lever

Use only genuine spare parts

Change the filters and the membrane regularly

Fig. 5.2.12: Dos and don'ts of maintenance

## 5.2.2 Troubleshooting

Troubleshooting refers to repair of faulty products or processes. It begins with searching for the source of a problem and ends with finding the solution for that problem to ensure that the product or process functions properly. Good troubleshooting consists of the following four steps:

- Identification of the symptoms
- Elimination of the causes of a problem
- Verification of the solution
- Restoration of the product or process

The field technician should follow some simple steps for troubleshooting as shown in the following figure:

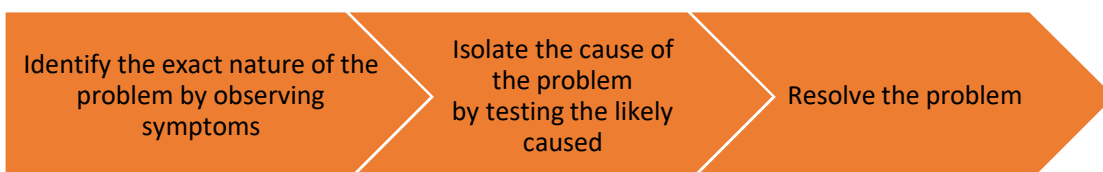


Fig.5.2.13: Steps for troubleshooting

## Troubleshooting Chart

The following table lists some common problems and their solutions:

Issue	Diagnosis	Solution
Not Enough /No water from Tap	Blocked or closed feed water input	<ul style="list-style-type: none"> <li>Open or unblock valve</li> </ul>
	Blocked sediment/carbon filter	<ul style="list-style-type: none"> <li>Replace filters</li> </ul>
	Closed tank valve	<ul style="list-style-type: none"> <li>Open valve</li> </ul>
	Blocked drain flow restrictor	<ul style="list-style-type: none"> <li>Replace drain flow restrictor</li> </ul>
	Membrane housing valve stuck	<ul style="list-style-type: none"> <li>Replace check valve</li> </ul>
	Malfunctioning automatic shut-off valve	<ul style="list-style-type: none"> <li>Replace automatic shut-off valve</li> </ul>
	Membrane polluted	<ul style="list-style-type: none"> <li>Replace membrane</li> </ul>
Low pressure from water outlet tap/faucet	Incorrect air pressure in storage tank	<ul style="list-style-type: none"> <li>Empty storage tank</li> <li>Find the air valve stem and add air till all water is removed</li> <li>Pressurize the tank to 8 PSI</li> <li>Reinstall the tank</li> <li>Turn on the feed supply</li> </ul>
	Blocked post carbon filter	<ul style="list-style-type: none"> <li>Replace post carbon filter</li> </ul>
	Partially closed tank valve	<ul style="list-style-type: none"> <li>Open valve</li> </ul>
	Faulty faucet	<ul style="list-style-type: none"> <li>Replace faucet</li> </ul>

High TDS in output water	Blocked pre-filter	<ul style="list-style-type: none"> <li>• Replace pre-filter</li> </ul>
	Incorrectly sealed membrane	<ul style="list-style-type: none"> <li>• Install the membrane correctly</li> </ul>
	Exhausted membrane	<ul style="list-style-type: none"> <li>• Replace membrane</li> </ul>
	Output and drain water lines reversed	<ul style="list-style-type: none"> <li>• Swap the connections</li> </ul>
	Malfunctioning automatic shut-off valve	<ul style="list-style-type: none"> <li>• Replace automatic shut-off valve</li> </ul>
	Dirty post-carbon filter	<ul style="list-style-type: none"> <li>• Clean/replace post-carbon filter</li> </ul>
Bad taste or odour	Blocked post carbon filter	<ul style="list-style-type: none"> <li>• Replace post carbon filter</li> </ul>
	Exhausted membrane	<ul style="list-style-type: none"> <li>• Replace membrane</li> </ul>
	Dirty storage tank	<ul style="list-style-type: none"> <li>• Clean storage tank</li> </ul>
	Water in storage tank left for a long time	<ul style="list-style-type: none"> <li>• Drain and clean storage tank</li> </ul>
Leaking membrane housing	Leak in threaded end cap	<ul style="list-style-type: none"> <li>• Lubricate O-ring and tighten cap</li> <li>• Replace O-ring if leak continues</li> </ul>
	Leak in cap or body of housing	<ul style="list-style-type: none"> <li>• Check housing/ cap for cracks</li> <li>• Replace if cracked or damaged</li> </ul>



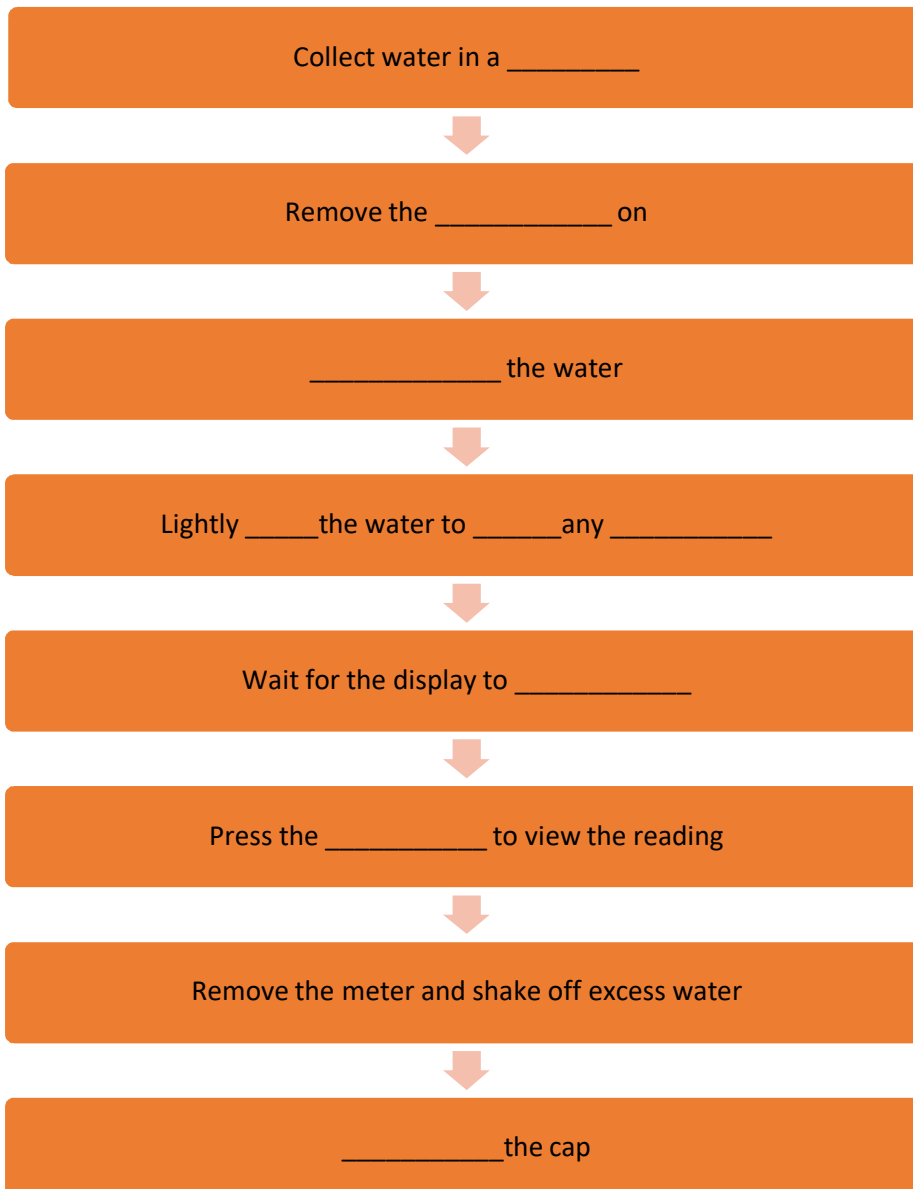
Leaking filter housing	Improper O-ring seating	<ul style="list-style-type: none"> <li>• Seat O-ring in groove</li> <li>• If dirty, clean and lubricate O-ring</li> <li>• Replace if cracked or damaged</li> </ul>
	Housing cap loose	<ul style="list-style-type: none"> <li>• Hand tighten cap properly</li> </ul>
	Damaged housing	<ul style="list-style-type: none"> <li>• Replace if cracked or damaged</li> </ul>
Leaking fitting	Damaged or cracked fitting	<ul style="list-style-type: none"> <li>• Replace fitting</li> </ul>
	Improper tubing or thread installation	<ul style="list-style-type: none"> <li>• Check and correct tubing and thread installation</li> </ul>
System continuously running	Automatic shut-off valve not working	<ul style="list-style-type: none"> <li>• Replace Automatic shut-off valve</li> </ul>
	Low incoming water pressure	<ul style="list-style-type: none"> <li>• Increase water pressure to 40 psi</li> </ul>
	Low air pressure in storage tank	<ul style="list-style-type: none"> <li>• Increase air pressure to 5 - 7 psi when empty</li> </ul>
	Damaged storage tank	<ul style="list-style-type: none"> <li>• Replace storage tank</li> </ul>
	Worn out flow restrictor	<ul style="list-style-type: none"> <li>• Replace flow restrictor</li> </ul>
	Incorrectly installed membrane	<ul style="list-style-type: none"> <li>• Check membrane installation</li> </ul>
Milky water	New System or filters	<ul style="list-style-type: none"> <li>• Air in lines - will go way with use</li> </ul>
	Water supply	<ul style="list-style-type: none"> <li>• High oxygen content - will go way with use</li> </ul>
	Bad membrane	<ul style="list-style-type: none"> <li>• Check TDS of water</li> <li>• Replace membrane</li> </ul>
Noisy drain/ faucet	Air gap faucet	<ul style="list-style-type: none"> <li>• Check air gap is properly installed</li> </ul>
	Drain tube	<ul style="list-style-type: none"> <li>• Check drain line for loops, bends, dips or kinks</li> </ul>

## Activity: Identification Game



A technician needs to take TDS measurement of a water sample? Fill in the blank steps to complete the procedure.

### Steps:



**Activity: Identification Game**

Match the RO system with the recommended duration for changing them.

1. Carbon post filter	I. Changes every 6 – 12 months
2. Reverse Osmosis membrane	II. Changes every 6 – 12 months
3. Carbon filter	III. Changes every 12 months
4. Sediment filter	IV. Changes every 24 months

**Practical**

The water purifier is giving low water pressure from dispensing faucet. How would you fix this?

**Equipment:**

- Wrench
- Spanner

**Hints:**

- Empty the water from holding tank.
- Shut off feed water.
- Remove holding tank from under sink.
- Locate the air valve stem and add air.

## UNIT 5.3: Safety Rules

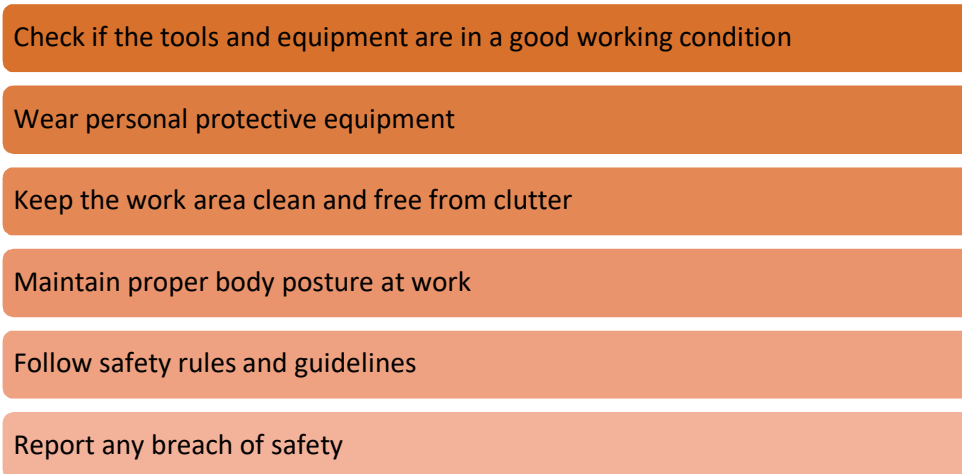
### Unit Objectives

At the end of this unit, you will be able to:

- List the safety rules

### 5.3.1 General Safety Procedures

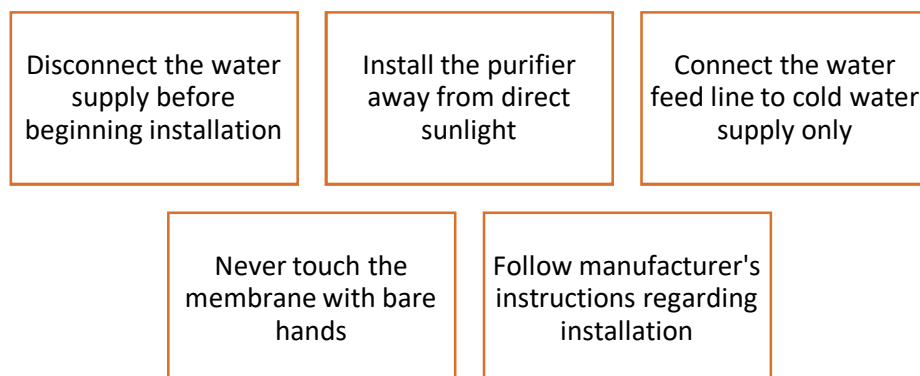
The field technician must adhere to the safety procedures. There are certain guidelines that must be followed to ensure own safety. These guidelines provide a sound, safe and flexible environment to work. The following figure explains the general safety guidelines that must be followed by a field technician:



*Fig. 5.3.1: General safety procedures*

### Safety Procedures to be Followed While Installation

The following figure explains the safety guidelines that must be followed by a field technician when installing an RO system:



*Fig. 5.3.2: Safety procedures during installation*

## Safety Procedures to be Followed While Doing Repair or Maintenance

The following figure explains the safety guidelines that must be followed by a field technician when doing repair or maintenance of an RO system:

Ensure that all connections are secure

Never apply bleach or cleaning solution to the membrane

Do not keep the filter cartridge outside its packing

Do not dip the TDS meter beyond the water limit

*Fig. 5.3.3: Safety procedures while doing repair or maintenance*

**Activity: Role Play** 

While drilling the wall to install a water purifier a tiny particle of the wall went inside your eyes. There's no one right next to you. How should the situation be handled?





## 6. Repairing Mixer/ Grinder /Juicer



Unit 6.1 – Mixer/ Grinder /Juicer

Unit 6.2 – Repair Mixer/ Grinder /Juicer

Unit 6.3 – Safety Rules



## Key Learning Outcomes

**At the end of this module, you will be able to:**

- Define mixer/grinder/juicer
- Identify different types of mixer/grinder/juicer
- Describe the parts and working of mixer/grinder/juicer
- Perform the cleaning of mixer/grinder/juicer
- Troubleshooting mixer/grinder/juicer problems
- Servicing/replacing the components of mixer/grinder /juicer
- Practice safety measure while using mixer/grinder/juicer

## UNIT 6.1: Mixer/ Grinder /Juicer

### Unit Objectives

**At the end of this unit, you will be able to:**

- Define mixer/grinder/juicer
- Identify different types of mixer/grinder/juicer
- Recognize parts of mixer/grinder/juicer
- Describe working of mixer/grinder/juicer
- Perform the cleaning of mixer/grinder/juicer

### 6.1.1 What is a Mixer/Grinder?

It is an electrical kitchen appliance used for mixing and grinding food. It has different jars for mixing, wet grinding and dry grinding. It uses gears to rotate a set of beaters to mix food contained in a bowl. The high-speed spinning blade grinds the material while mixing it. The following figure shows a common household mixer/grinder:



*Fig 6.1.1: Mixer/Grinder*

## 6.1.2 Types of Mixers

There are many types of mixers depending on their usage. The following figure shows the different types of mixers:



### Stand mixer

- Contains attachments such as whisk, beater and dough hook to mix different type of ingredients



### Hand Mixer

- Hand-held mixing device. The handle is mounted on enclosed motor which drives the beaters



### Spiral mixer

- Contains a stationary spiral shaped agitator and rotating bowl



### Planetary mixer

- Contains a stationary bowl and rotating agitator to mix, whip or blend ingredients



### Dough mixer

- Used for kneading large quantities of dough

*Fig 6.1.2: Types of mixers*

### 6.1.3 Parts of Mixer

The following figure shows the different parts of a mixer /grinder:









Sr. No.	Image	Part
1		Lid
2		Liquidizing jar
3		Dry grinding jar
4		Wet grinding jar
5		Blender grinding blade
6		Dry grinding blade
7		Wet grinding blade
8		Base unit

Fig 6.1.3: Parts of mixer

## Before First Use

The following figure lists the things to check before using the mixer/grinder for the first time:

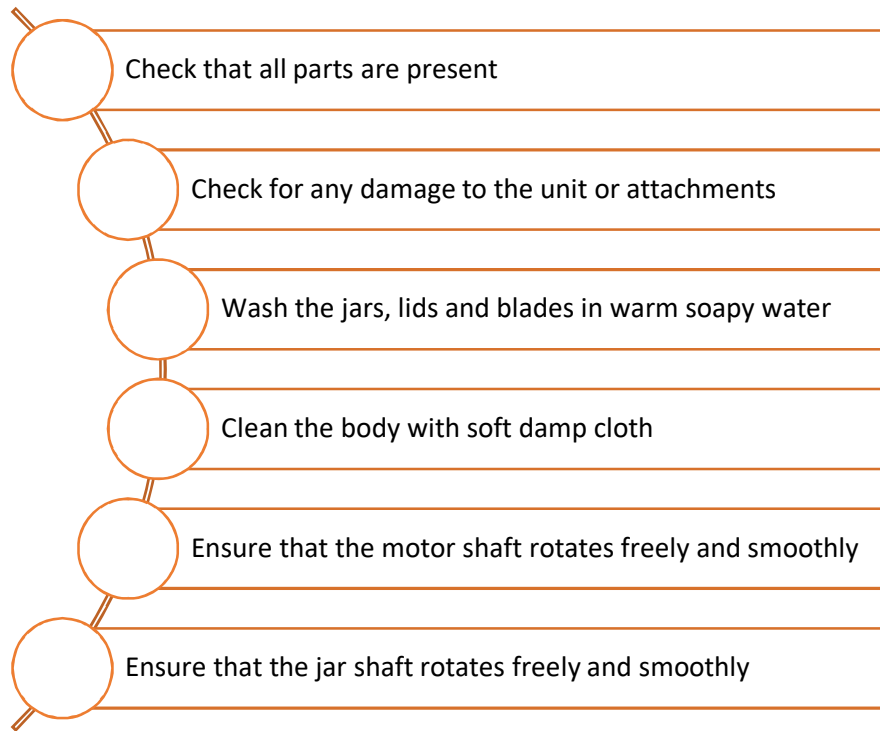


Fig 6.1.4: Check before using the mixer/grinder

## Using Mixer/Grinder

A mixer/grinder is very simple and easy to use. The following figure lists the steps of using a mixer/grinder:

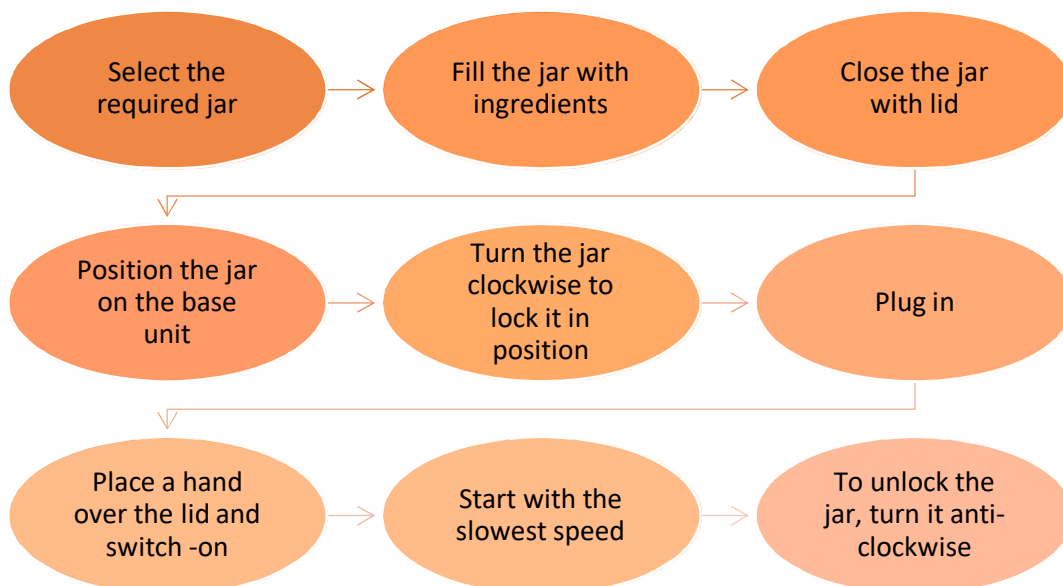


Fig 6.1.5: Using a mixer/grinder

## Auto Overload Protector (OLP)

The mixer/grinder comes equipped with protection against sudden overloads. In such situations, the OLP trips and the mixer/grinder shuts-off immediately. This protects the unit from burning and enhances the motor life. The OLP button is located at the bottom of the unit. The following figure shows the location of OLP in a mixer/grinder:

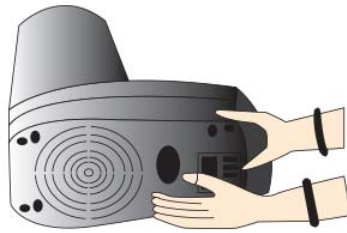


Fig 6.1.6: Location of OLP in a mixer/grinder

The following figure lists the steps in case the mixer/grinder stops due to OLP:

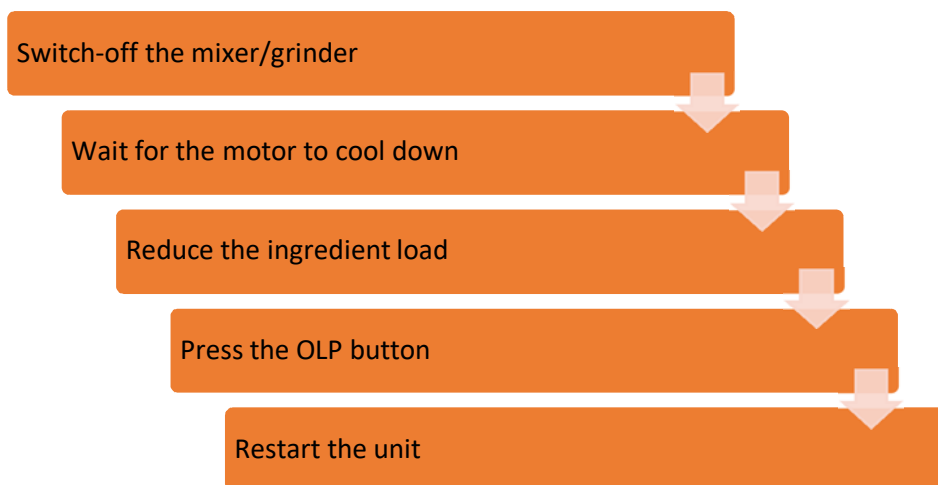


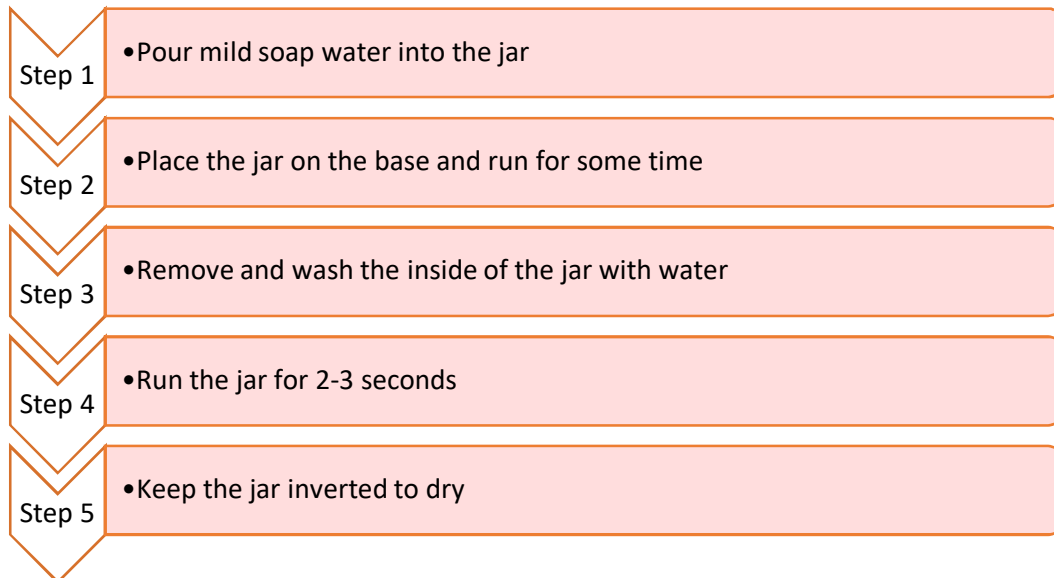
Fig 6.1.7: Steps to follow when the mixer/grinder stops due to OLP

## Cleaning the mixer/grinder

All the parts of a mixer/grinder such as jars, blades and the base unit should be cleaned thoroughly after every use.

## Cleaning the jars

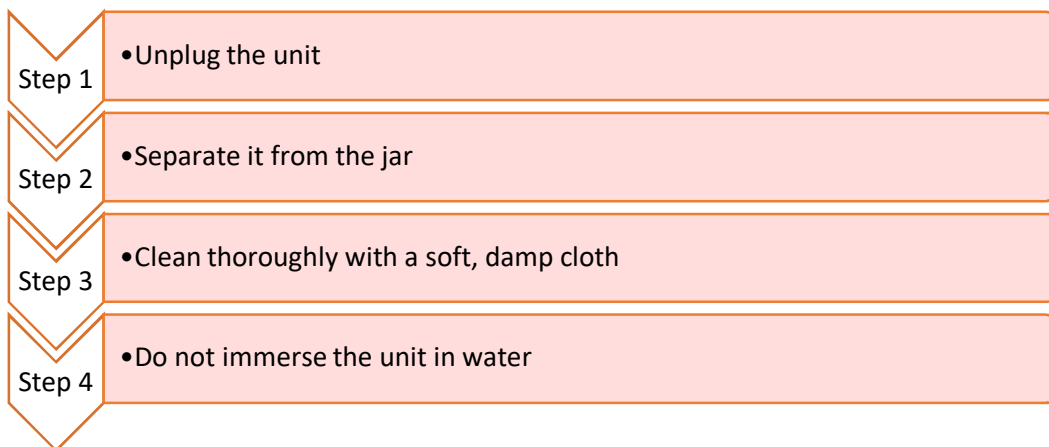
The following figure shows the steps of cleaning the jars of a mixer/grinder:



*Fig 6.1.8: Cleaning the jar of a mixer/grinder*

## Cleaning the base unit

The following figure shows the steps of cleaning the base unit of a mixer/grinder:

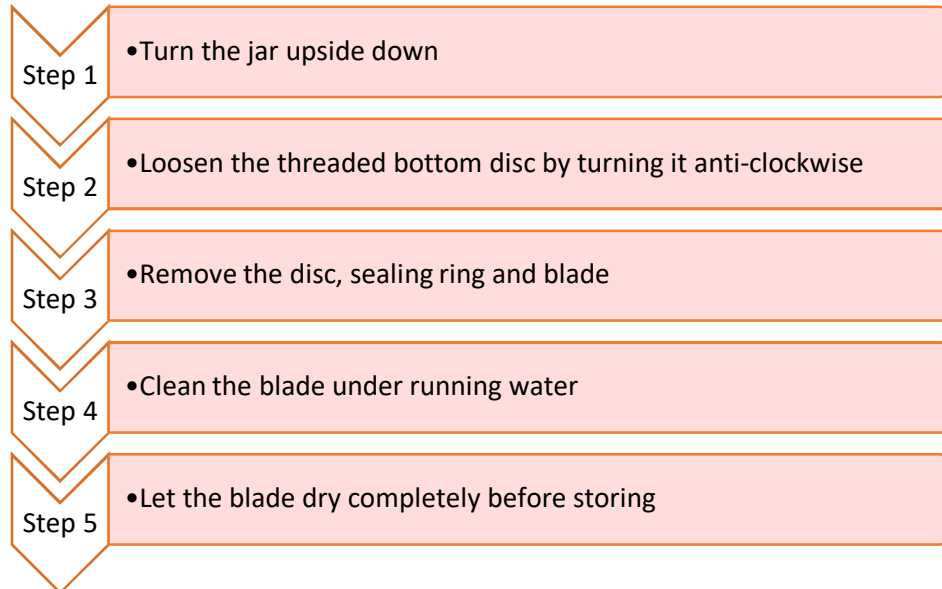


*Fig 6.1.9: Cleaning the base of a mixer/grinder*



## Cleaning the blades

The following figure shows the steps of cleaning the blades of a mixer/grinder:



*Fig 6.1.10: Cleaning the blades of a mixer/grinder*

## 6.1.4 What is Juicer?

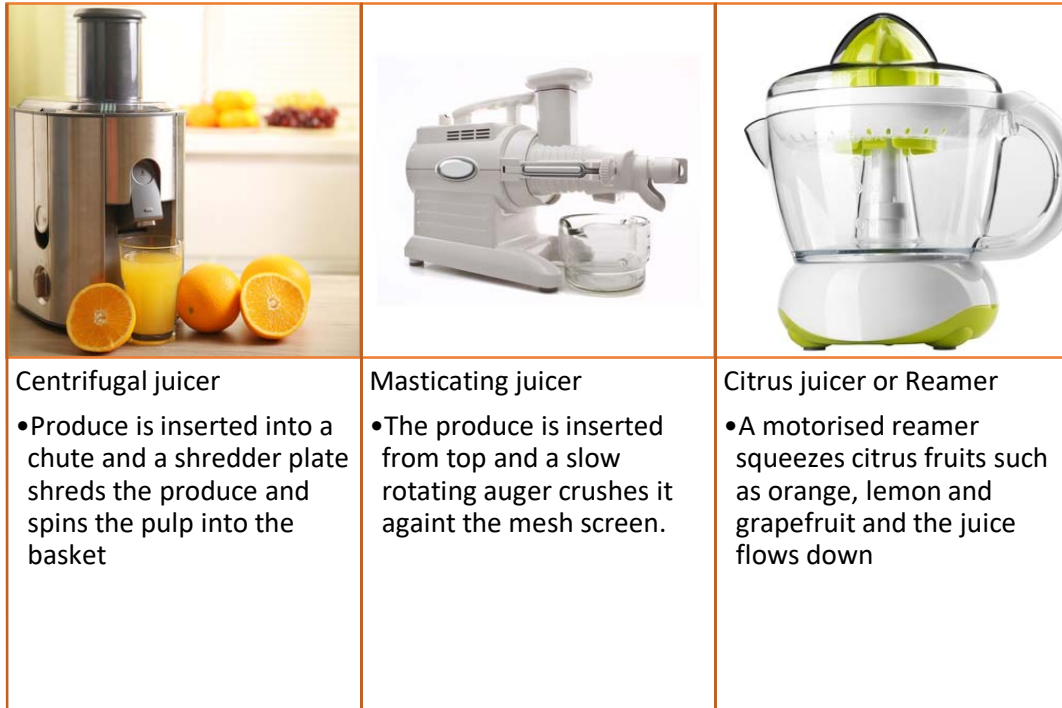
It is an electrical kitchen appliance used for extracting juice out of fruits and vegetables. It crushes or shreds the fruits and vegetables against a mesh filter that separates pulp from liquid content. The following figure shows a common household juicer:



*Fig 6.1.11: Juicer*

### 6.1.5 Types of Juicers

There are many types of juicers depending on their how the juice is extracted. The following figure shows the different types of juicers:



#### Centrifugal juicer

- Produce is inserted into a chute and a shredder plate shreds the produce and spins the pulp into the basket

#### Masticating juicer

- The produce is inserted from top and a slow rotating auger crushes it against the mesh screen.




#### Citrus juicer or Reamer








- A motorised reamer squeezes citrus fruits such as orange, lemon and grapefruit and the juice flows down

Fig 6.1.12: Types of juicers

### 6.1.6 Parts of Juicer


The following table shows the different parts of juicer:

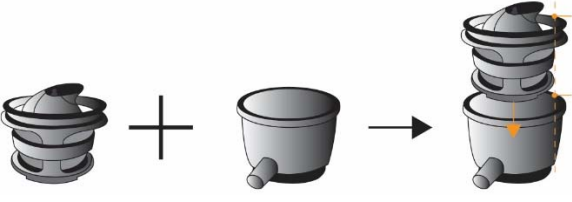
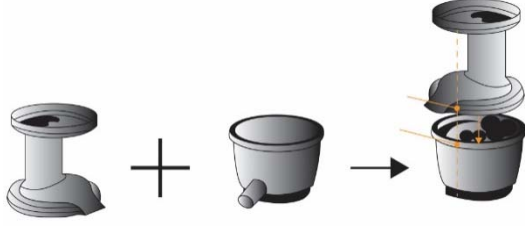
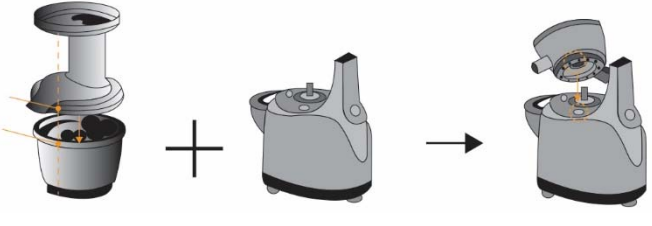

Sr. No.	Image	Parts
1		Plunger
2		Hopper
3		Drum lid

4		Juicing screw
5		Strainer
6		Rotation wiper
7		Juicing bowl
8		Base
9		Pulp cup
10		Juice cup

## Assembling Juicer





The following table shows the steps to assemble different parts of juicer

Step	Parts	Process
1		<p>Put the juicing screw into strainer.</p> <p>Position the set into rotation wiper.</p> <p>Turn until the juicing screw clicks into position.</p>

2		<p>Push the strainer down the juicing bowl until it clicks into position</p>
3		<p>Position the drum lid on the juicing bowl</p>
4		<p>Assemble the top set onto the base</p> <p>Ensure that it clicks into place</p>
5		<p>Position the juice cup and the pulp cup into their place</p>

## Disassembling Juicer

The following table shows the steps to disassemble different parts of juicer:

Step	Parts	Process
1		Open the drum lid by turning it in anti-clockwise direction
2		Lift the juicing bowl off the base by turning it in anti-clockwise direction
3		Separate the bowl from the set of rotation wiper, strainer and juicing screw
4		Disassemble the juicing screw and strainer from the rotation wiper

## Using Juicer

A juicer is very simple and easy to use. The following figure shows the steps of using a juicer:

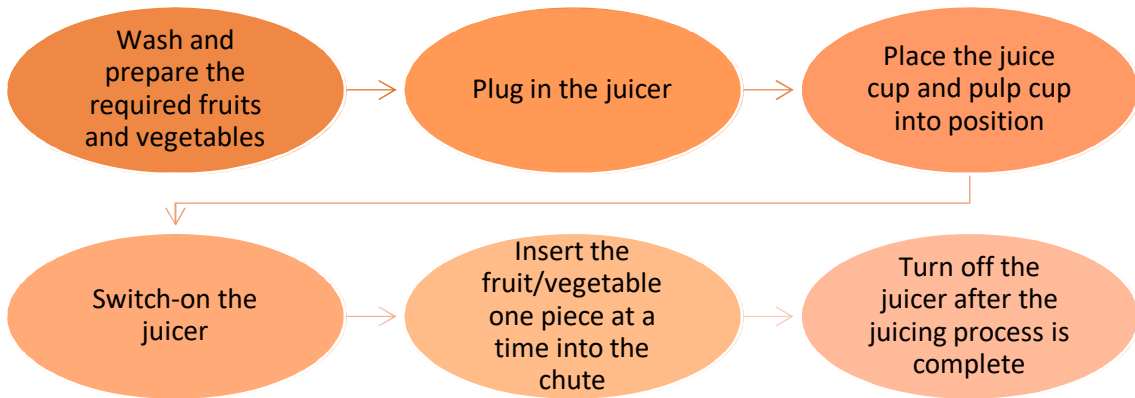


Fig 6.1.13: Using a juicer

## Cleaning juicer

It is very important to take proper care of juicer. It should be cleaned thoroughly after every use. The following figure shows the steps of cleaning a juicer:

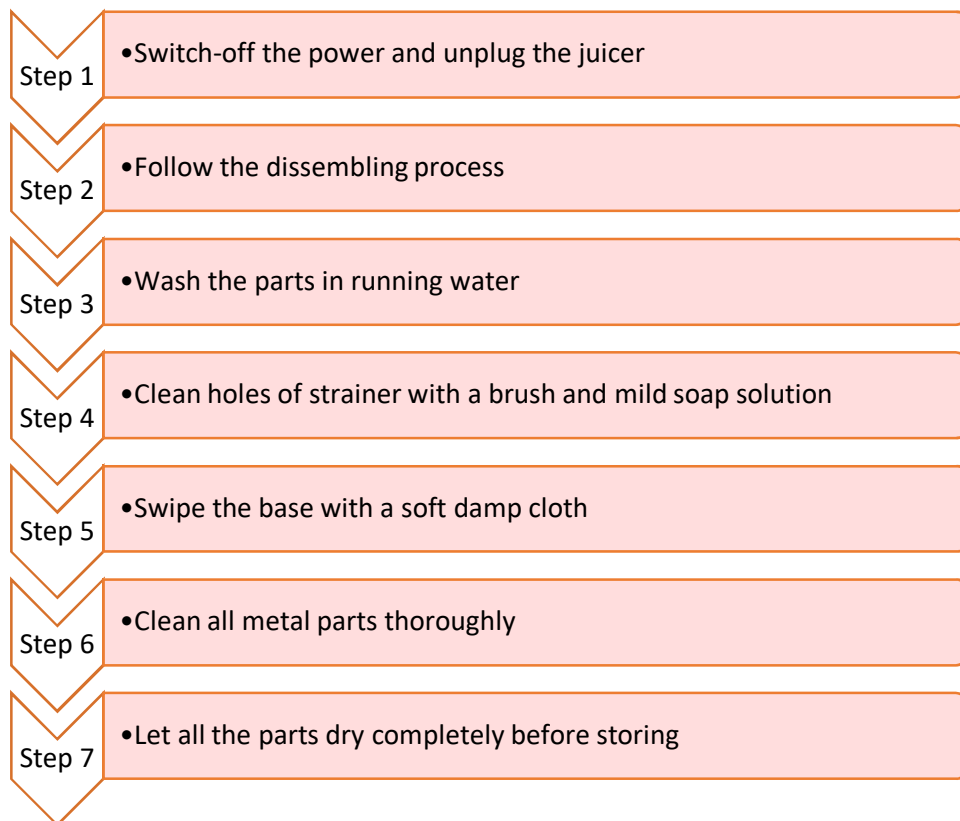






Fig 6.1.14: Cleaning a juicer

### Activity: Identification Game

Match the following parts of the juicer with their respective images:

1.	Pulp cup	A.	
2.	Rotation wiper	B.	
3.	Hopper	C.	
4.	Juicing screw	D.	

## UNIT 6.2: Repairing Mixer/Grinder/Juicer

### Unit Objectives

**At the end of this unit, you will be able to:**

- Troubleshooting mixer/grinder problems
- Servicing/replacing the components of mixer/grinder
- Troubleshooting juicer problems
- Repairing/Servicing the Juicer

### 6.2.1 Troubleshooting Mixer/Grinder Problems

Some frequently occurring mixer/grinder problems and their solutions are given in the following table:

Sr. No.	Problems	Solution
1	Unit fails to start	<ul style="list-style-type: none"> <li>• Ensure cord is plugged-in properly</li> <li>• Ensure power supply is active</li> <li>• Ensure the unit is switched-on</li> <li>• Ensure that the jar is not overloaded</li> </ul>
2	Motor stopped	<ul style="list-style-type: none"> <li>• Ensure cord is plugged-in properly</li> <li>• Ensure that the grinder safety knob is not loose</li> <li>• Switch-off the unit and unplug</li> <li>• Let the juicer cool down from overheating</li> </ul>
3	Mixer does not function at all speeds	<ul style="list-style-type: none"> <li>• Check the speed control</li> <li>• Replace if defective</li> </ul>
4	Motor hums but beaters don't rotate	<ul style="list-style-type: none"> <li>• Check motor</li> <li>• Replace if defective</li> </ul>
5	Excessive vibration in mixer	<ul style="list-style-type: none"> <li>• Check and replace beaters if defective</li> <li>• Check and service gears if broken or misaligned</li> <li>• Check and replace motor if defective</li> </ul>
6	Mixer noisy	<ul style="list-style-type: none"> <li>• Switch-off the mixer and unplug</li> <li>• Stir the contents into middle of jar from the walls</li> <li>• Add water and start</li> </ul>



7	Overflowing jar	<ul style="list-style-type: none"> <li>• Check and reduce excess liquid from jar</li> <li>• Check and fit the cap properly</li> </ul>
8	Jar leaking from below	<ul style="list-style-type: none"> <li>• Check blade shaft/ jar brush</li> <li>• Replace if worn-out</li> </ul>

## 6.2.2 Servicing/Replacing the Components of Mixer/Grinder

To ensure that the mixer/grinder functions properly, it is important to do servicing of components such as speed control switch and gears.

### Servicing the Speed Control Switch

A switch is a simple component that is used to stop or start the operation of any motor. A speed control switch is a three speed switch used to select low, medium or high speed by rotating the knob. The speed is controlled by providing varying current to the motor of the mixer/grinder. The following figure lists the steps of servicing a switch:

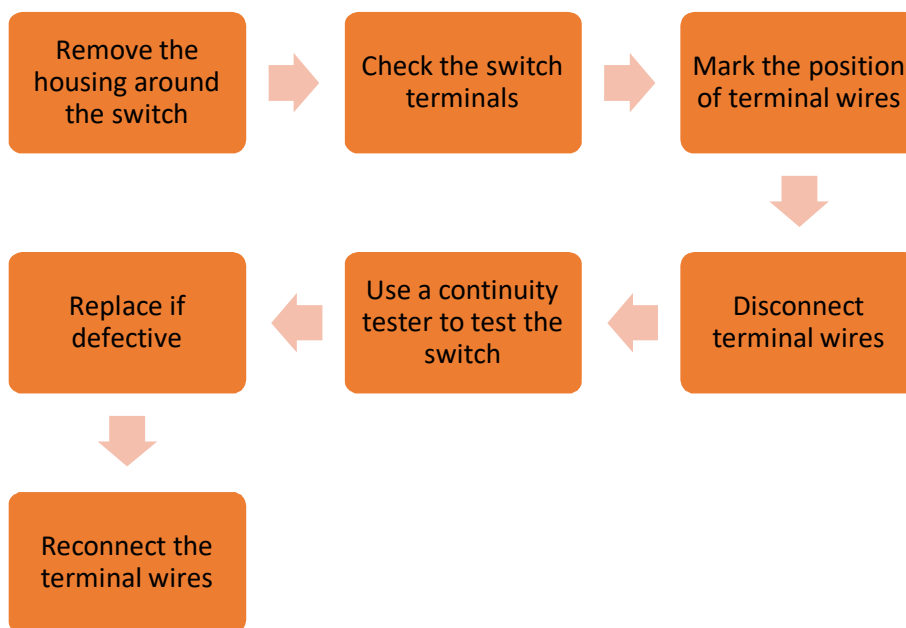


Fig 6.2.1: Servicing a speed control switch

### Servicing the Gears

The mixer/ grinder has a gear mechanism that rotates the beaters in opposite directions to mix the ingredients.

The following figure lists the steps of servicing the gears:



Fig 6.2.2: Servicing the gears

## Replacing a fuse

A fuse is device used to protect the wiring of an electrical appliance from overheating and catching fire due to overload or short circuit. If the motor of the mixer/grinder stops working, its fuse may be blown. The following figure lists the steps of replacing a fuse:

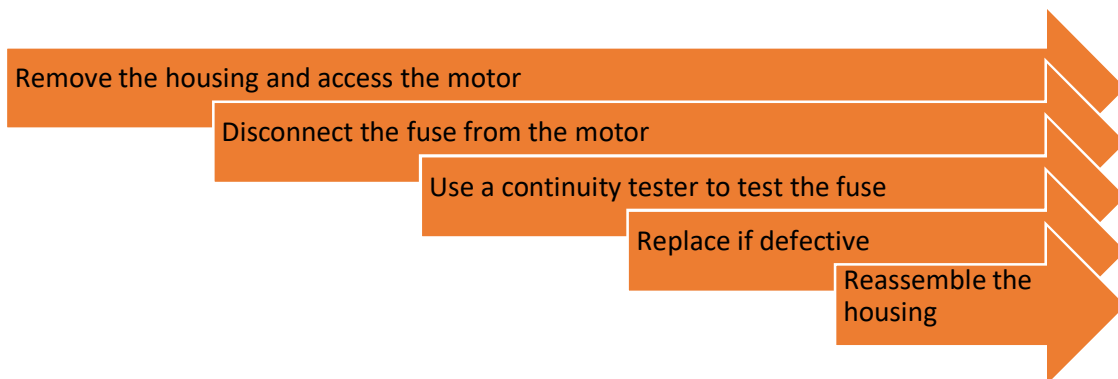


Fig 6.2.3: Replacing a fuse

## Replacing the motor

The mixer/grinder/juicer runs on a single-phase induction motor. The following figure lists the steps of replacing the motor:

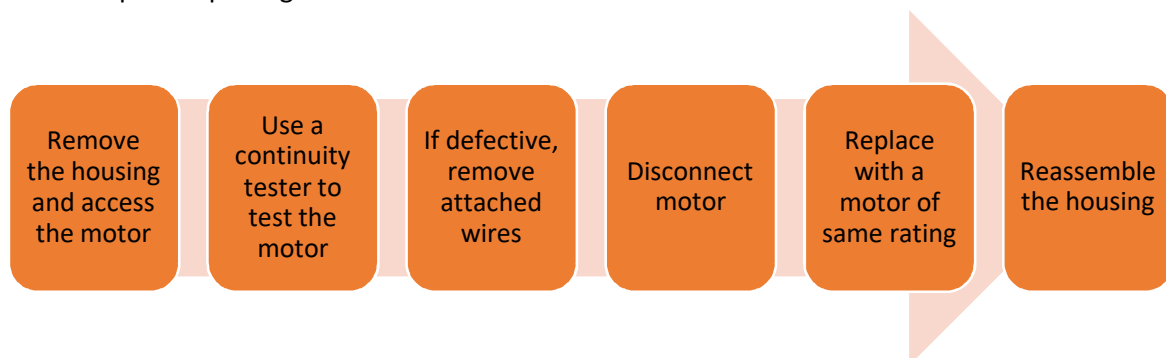


Fig 6.2.4: Replacing the motor

### 6.2.3 Troubleshooting juicer problems

Some frequently occurring juicer problems and their solutions are given in the following table:

Sr. No.	Problems	Solution
1	Unit fails to start	<ul style="list-style-type: none"> <li>• Ensure cord is plugged-in properly</li> <li>• Ensure power supply is active</li> <li>• Ensure the juicer is switched-on</li> </ul>
2	Motor stopped	<ul style="list-style-type: none"> <li>• Ensure cord is plugged-in properly</li> <li>• Ensure parts are correctly assembled</li> <li>• Switch-off the juicer and unplug</li> <li>• Let the juicer cool down from overheating</li> </ul>
3	Juicer noisy	<ul style="list-style-type: none"> <li>• Switch-off the juicer and unplug</li> <li>• Ensure parts are correctly assembled</li> <li>• Ensure juicer is on level surface</li> <li>• Ensure ingredients are cut properly</li> </ul>
4	Juice leaks from top	<ul style="list-style-type: none"> <li>• Switch-off the juicer and unplug</li> <li>• Check that the compression silicone is assembled properly</li> <li>• If not, disassemble the juicer</li> <li>• Assemble the compression silicone properly</li> </ul>
5	Discoloration of plastic parts	<ul style="list-style-type: none"> <li>• Clean the juicer after every use</li> <li>• Rub the discoloured parts with cooking oil</li> <li>• Clean with mild soap</li> <li>• Remove and clean silicone parts separately</li> </ul>
6	Mold in silicone parts	<ul style="list-style-type: none"> <li>• Remove and clean silicone parts separately</li> </ul>
7	Strainer damaged	<ul style="list-style-type: none"> <li>• Refer to instructions manual for proper usage</li> <li>• Avoid overcrowding food or forcing food down the chute</li> </ul>
8	Attachments deformed	<ul style="list-style-type: none"> <li>• Avoid cleaning parts in dishwasher</li> <li>• Do not use harsh cleaners</li> </ul>

9	Too much pulp with juice	<ul style="list-style-type: none"> <li>• Cut food into smaller parts</li> <li>• Insert food slowly</li> <li>• Allow all the pulp to eject before adding more food</li> </ul>
10	Reduced juice output	<ul style="list-style-type: none"> <li>• Ensure that the spout is fully opened</li> <li>• Ensure that there is no excess pulp in filter basket</li> <li>• If yes, stop the juicer and clean filter basket</li> </ul>
11	Handle lock not closing	<ul style="list-style-type: none"> <li>• Push down on the locking tab</li> <li>• Open the lock fully</li> <li>• Press down and close the lock properly</li> </ul>

## 6.2.4 Repairing/Serviceing the Juicer

The following figure lists the steps of repairing a juicer:

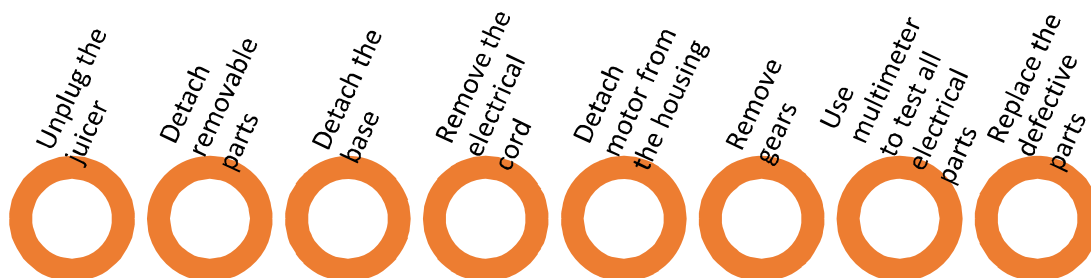


Fig 6.2.5: Repairing a juicer

### Serviceing the juicer drive system

The following figure lists the steps of serviceing the juicer drive system:

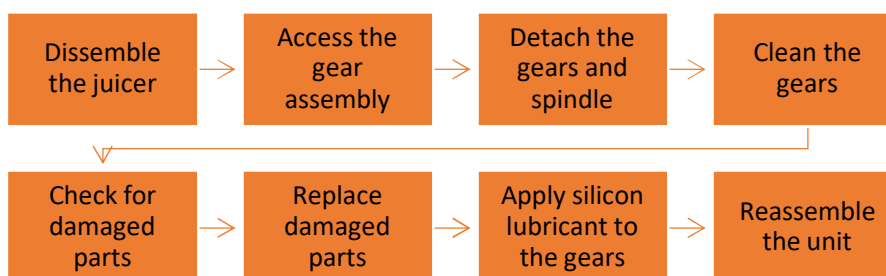


Fig 6.2.6: Serviceing the juicer drive system

**Activity: Identification Game**

State whether the following statements are True or False:

1. If the jar of a mixer/grinder is leaking from the bottom, it can be due to worn out blade shaft.

\_\_\_\_\_

2. A defective motor leads to an excessive vibration in the mixer/grinder.

\_\_\_\_\_

3. To remove the discoloration of plastic parts of a juicer, clean them with bleach.

\_\_\_\_\_

4. If the juicer is placed on an uneven surface, it will not start.

\_\_\_\_\_

## Practical



The blade of a mixer/grinder is jammed and is not turning. Perform the steps required to correct the problem.

### Equipment:

- Wrenches
- Screwdrivers
- Lubricants like WD40

### Hints:

- Pour the lubricant inside the mixer grinder by keeping it upside down.
- Keep it for some time, then use pliers to twist the motor coupler.
- Clean the jar with mild soap solution.

## Practical

Repair dysfunctional motor of a mixer grinder

### Equipment:

- Multimeter
- Power probe
- Wrenches
- Screwdrivers

### Hints:

- Disconnect the power cord from motor.
- Perform continuity test on the motor.
- Attach one of the multimeter's probes to the motor's common lead.
- Attach the other probe in turn to each of the other wires on the motor.

## Practical



Perform the following activities.

- The steps for servicing a motor's drive mechanism
- The steps for servicing a motor's gears
- The steps for servicing a motor's fan blades

### Equipment:

- Multimeter
- Power probe
- Wrenches
- Screwdrivers

### Hints:

- Service a motor's drive mechanism:
  - Tighten the setscrew
  - Adjust the drive belt
- Service a motor's gears:
  - Disassemble the appliance to access the motor's gears.
  - Remove and inspect gears.
  - Reassemble and test.
- Service a motor's fan blades:
  - Disassemble the appliance to access the motor's fan blade.
  - Remove, inspect, and repair the fan blades.
  - Reassemble and test.



## UNIT 6.3: Safety Rules

### Unit Objectives

**At the end of this unit, you will be able to:**

- Recognize safety measure performed before using mixer/grinder/juicer
- Practice safety measure while using mixer/grinder/juicer

### 6.3.1 Safety Measures before Using Mixer/ Grinder/Juicer

Mixer/ Grinder/Juicer are used in every household nowadays but only few people are aware about its proper placing. The following figure lists the safety measures for placing mixer/ grinder/juicer:

Place the appliance on an even platform at a convenient height

Ensure that the appliance is atleast 6 inches away from the wall

Have sufficient space around the appliance

Keep away from heat and sunlight

Do not use an extension cord

Do not use an adapter

Do not remove ground prong

*Fig 6.3.1: Instructions for placing mixer/grinder/juicer*

### 6.3.2 Safety Measure for Operating Mixer/ Grinder/Juicer

The following figure lists the instructions to be followed for operating a mixer /grinder/juicer:

Read all instructions, operating procedures and safety precautions before use

Do not put the appliance in water

Unplug the appliance when not in use, before cleaning or taking off parts

Keep hands, hair and clothing away from moving parts

Do not operate if cord or plug is damaged

Avoid the usage of appliance outdoors

Do not let the cord hang from the edge of table or counter

Ensure that the appliance cover is clamped securely

Do not unfasten clamps while the appliance is running

Remove wire whip, flat beater or dough hook from mixer before washing

Do not leave the appliance unattended around children.

*Fig 6.3.2: Instructions for operating mixer/grinder/juicer*

**Activity: Identification Game**

State whether the following statements are True or False:

1. It is safe to use extension cord with the mixer/grinder. \_\_\_\_\_
2. Always unplug the appliance before cleaning. \_\_\_\_\_
3. Do not remove the ground prong. \_\_\_\_\_
4. To clean the juicer base, immerse it in water. \_\_\_\_\_





# 7. Repairing Microwave Oven

Unit 7.1 – Microwave Oven

Unit 7.2 – Repair Microwave Oven

Unit 7.3 – Safety Rules



## Key Learning Outcomes

**At the end of this module, you will be able to:**

- Define microwave oven and its types
- Identify different parts of microwave oven
- Discuss customer's requirement
- Demonstrate replacing of water purifier component
- List the safety measure to be followed while repairing

## UNIT 7.1: Microwave Oven

### Unit Objectives

**At the end of this unit, you will be able to:**

- Define microwave oven
- Identify different types of microwave oven
- identify the parts of microwave oven
- Explain the working of microwave oven
- List advantages and disadvantages of microwave oven

### 7.1.1 What is Microwave Oven?

It is a small kitchen appliance that is used for heating and cooking the food. The food is heated by the microwave radiations which is passed through it. It was invented by Percy Spencer, an American self-taught engineer from Howland, Maine. While he was experimenting on an active radar set, it came to his notice that the microwaves generated by the radar set melted the candy bar present in his pocket. He then realized that the microwaves can also cook food. So, he invented microwave oven for cooking and heating the food.



In microwave oven, the food item is exposed to the radiations of the microwave, in the EM spectrum. The polar molecule dwelling inside the food particles rotates as the microwave radiation induces the molecules as well as it produces thermal energy. This leads to rapid motion of polarized water molecule in the food, they get pulled back and forth many a times in a span of one second. The rapid motion occurring between the water molecules produces friction, therefore heat is generated. Dielectric heating is the process by which the substances present in food such as water, absorbs the energy from microwaves.

### Tips

Microwaves are non-ionizing electromagnetic radiation comprising of frequency greater than standard radio waves yet lower than infrared light. The frequency used in microwaves is one of the industrial, scientific, medical (ISM) bands. These bands are reserved so that they don't interfere with the other important radio services.

The hot and cold spots present on the food turntable are produced by the interference effect of the microwaves. The turntable or rotating source is used to scatter the heat around the food. Food's properties plays a vital role for cooking it used a particular amount of microwave energy.

Microwave uses the combination of these three process to cook the food kept inside it. The center of the food is mainly cooked by heat conduction as the heat only penetrates about 3.5 to 5 cm into the food. The following figure lists three ways with which heat is transferred into the surroundings:

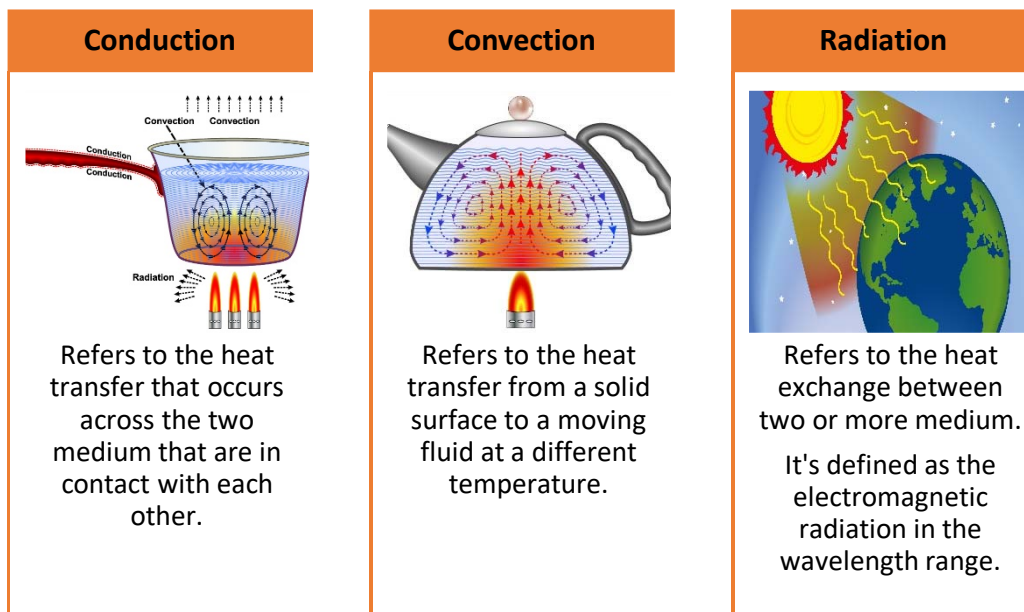


Fig 7.1.1: Three ways of heat transfer

### Tips

Due to restriction of movement of the molecules present in frozen water, heating liquid water through microwave gives better results.

There are two most common attributes related to microwave cooking are:

- Power-The standard wattage for a microwave is between 900 to 1200 watts. For smaller microwaves the wattage ranges between 600 to 800 watts and can cook items from between two to three minutes. Microwaves with a lower wattage take a longer time to cook when compared to microwaves with a higher wattage.
- Timing - The correct duration to prevent under-cooking or over-cooking. Timing of cooking depends on following factors:
  - Quantity
  - Shape and size



- Density
- Moisture content
- Food temperature
- Sugar and fat contents

Selection of utensils and cooking methods are also important attributes.

### 7.1.2 Types of Microwave Oven

Food placed inside the oven could be grilled/baked/cooked. To perform all these process there are generally, three categories of microwave ovens available. The following figure list these ovens:



In solo models, micro waves are produced by only a single magnetron.

They can be utilized for cooking and heating or reheating purposes, but they are incapable of performing operations such as roasting and baking.

These models are the basic models in micro wave ovens.

In grill models, the microwave ovens are provided with heating coils that induces a grilling or roasting process.

Its microwave function is turned off, when the grill function is used.

A brown layer is created by the grilling process on the surface of the food article.



In convectional model, there is a micro wave function, the coils for grilling and heaters with a blower to bake the food.

It has an advantage, either all the functions are used independently or in combination to suit the cooking needs.

The cavity temperature is controlled using a thermostat connected to heaters.

Fig 7.1.2: Types of microwave oven

### 7.1.3 Parts of Microwave Oven

Microwave oven consists various parts due to which its functioning takes place some of the parts are shown in the image given below:

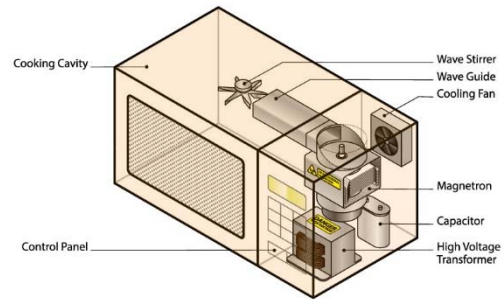


Fig 7.1.3: Parts of microwavce oven

The following figure lists parts of microwave oven:

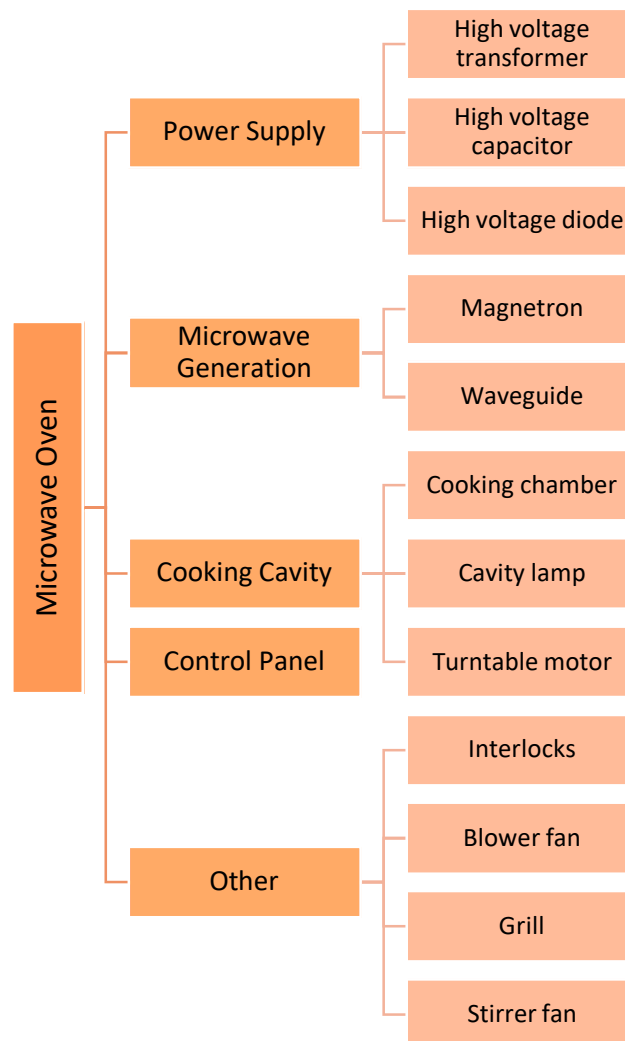


Fig 7.1.4: Parts of microwavce oven

## Power Supply

- **High voltage transformer:** It changes a high voltage power source which passes energy to the magnetron. It also drives filament for magnetron.
- **High voltage capacitor:** It is directly connected to the transformer, magnetron and via a diode to the chassis.
- **High voltage diode:** It is used to sustain high voltage surges in microwave circuit.

## Microwave Generation

Is dependent on the following:

- **Magnetron:** Converts high-voltage electric energy to microwave radiation.
- **Waveguide:** Controls the direction of the micro waves moving in the cooking chamber. It is done by confining the space of the releasing microwaves from the magnetron.

## Cooking Cavity

A cooking cavity of a microwave oven consists:

- **Cooking chamber:** It confines the output radiation so that food can get heated up.
- **Cavity lamp:** It is given to see the progress of food being cooked inside.
- **Turntable motor:** It is used to for even spread of heat as it rotates the food.

## Control Panel

Microwave oven uses either a digital control panel or an analog dial-type panel for operation. The following figure list the features present in the control panel:

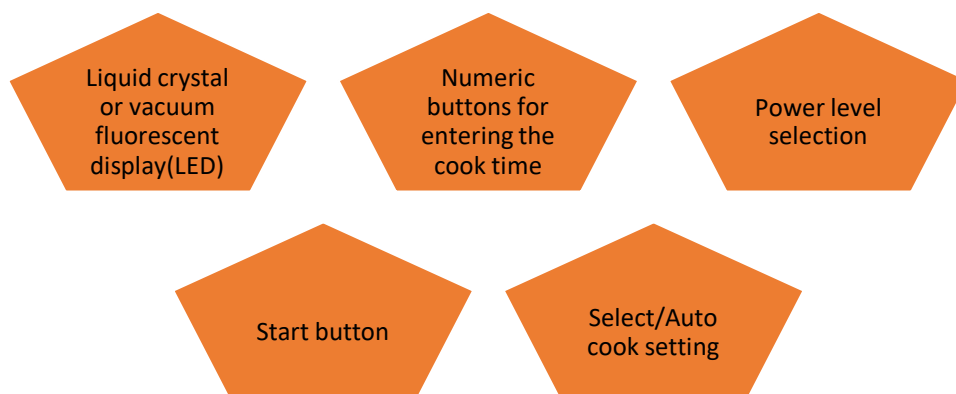
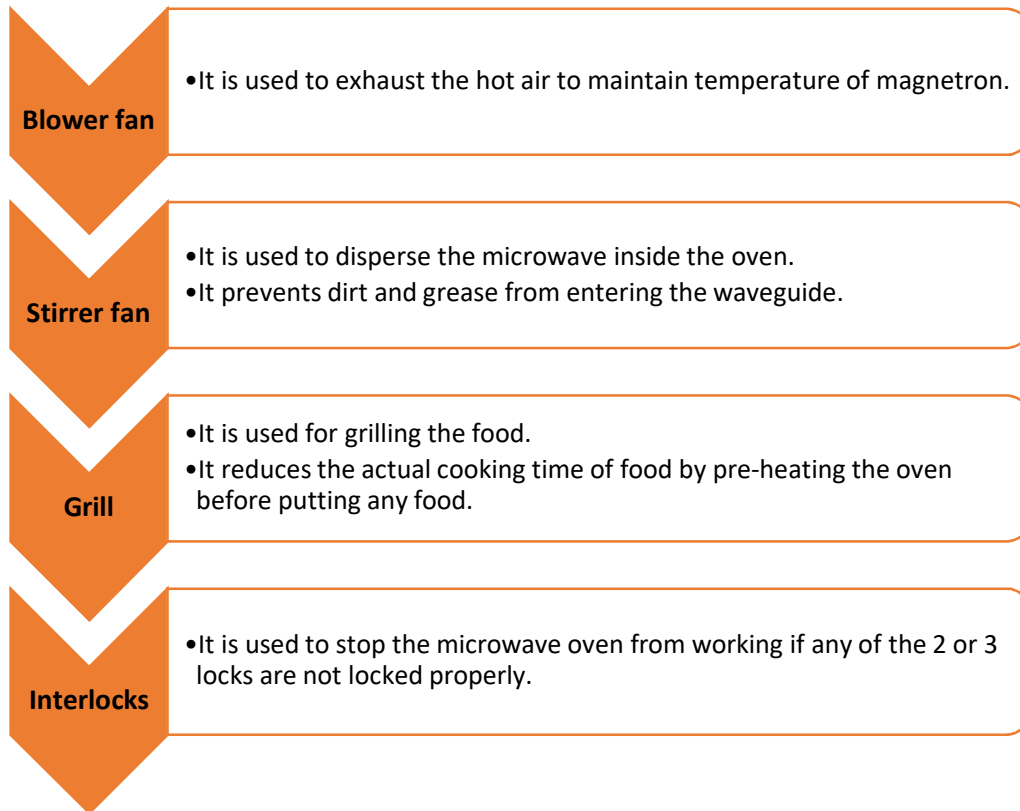


Fig 7.1.5: Features of microwavce oven

## Other Parts

The following figure lists the other essential parts present in the microwave oven:



*Fig 7.1.6: Other components of microwave oven*

### 7.1.4 Working of Microwave Oven

In microwave oven, magnetron is present inside a strong metal box. So, when the food is placed inside the chamber and timer is switched on, a signal is sent to magnetron to emit microwaves and simultaneously the turn table also starts turning.

The following figure lists the steps occurring after the cooking start:



1. The electricity is provided to the magnetron from the power outlet. It converts the electricity into high-powered, 12cm (4.7 inch) radio waves.
2. Three waves are blasted by the magnetron through a channel into the food compartment. This channel is called a wave guide.
3. The food which is present on the turntable, spins a slow round so it can be cooked evenly by the microwaves.
4. The water molecules are contacted by the micro waves. Then the water molecules start vibrating against each other at a very high speed generating heat.

*Fig 7.1.7: Working of microwave oven*

It is known that vibrating molecules emit heat. So, faster the molecules vibrate the quicker the food will get heated up. Therefore, we can say that the molecules present in the food cause rapid heat as micro waves pass on their energy to them.

### Tips

Food consisting fat and sugar gets less heated than water.

### 7.1.5 Advantages and Disadvantages

The following table lists the advantages and disadvantages of microwave oven:

Sr. No.	Advantages	Disadvantages
1	Cooking time is short	Constraint with metal container
2	Destruction of nutrients is less	Heat force control is difficult
3	No physical change of foods	Water evaporation (Dehydration)
4	Melting process is easy	Uneven cooking ( Hot and Cold spots)
5	Sterilization effect exists	Surface toasting is impossible

## Activity: Identification Game



Answer the following questions.

1. Which of the following microwave ovens all function works independently?



Solo

Grill

Convectional

2. Which of the following component in power supply changes high voltage power source which passes energy to the magnetron?

High voltage capacitor

High voltage transformer

High voltage diode

## Activity: Identification Game

Match the following components of a UPS/Inverter kit with their respective names and function.

<b>Names</b>	<b>Function</b>
1. Power Supply	A. Waveguide
2. Cooking activity	B. High voltage capacitor
3. Other	C. LED
4. Microwave generation	D. Turntable motor
5. Control Panel	E. Stirrer fan



## UNIT 7.2: Repairing Microwave Oven

### Unit Objectives

**At the end of this unit, you will be able to:**

- Recognize customer's requirement
- Practice repairing and replacing of faulty modules
- Educate customer about do's and don't's

### 7.2.1 Repairing and Replacing of Faulty Modules

One of the common causes of malfunctioning of microwave oven is due to non-compliance of user manual instructions or using the appliance inappropriately. Some frequently occurring problems and their causes are given below:

Sr. No.	Problems	Causes
1	Home fuse blows when a power cord is plugged into the wall receptacle	Shorted power cord or wire harness
2	Monitor fuse blows when harness power is applied.	<ol style="list-style-type: none"> <li>1. Shorted power cord or wire harness</li> <li>2. Secondary interlock or monitor switch</li> </ol>
3	Nothing displays on the display when power is plugged in	<ol style="list-style-type: none"> <li>1. Shorted or open wiring</li> <li>2. Monitor switch or monitor</li> <li>3. Oven temperature fuse</li> <li>4. Control unit</li> </ol>
4	No response after pressing STOP/CLEAR button.	<ol style="list-style-type: none"> <li>1. Primary interlock relay or door sensing switch</li> <li>2. Control unit</li> <li>3. Key unit</li> </ol>
5	Oven lamp does not light with Shorted or open wiring opened	<ol style="list-style-type: none"> <li>1. Monitor fuse</li> <li>2. Oven temperature fuse door</li> <li>3. Oven lamp or socket</li> <li>4. Control unit</li> <li>5. Relay (RYI)</li> </ol>
6	Oven lamp does not light at all	<ol style="list-style-type: none"> <li>1. Shorted or open wiring</li> <li>2. Oven lamp or socket</li> </ol>

7	Oven lamp lights, but fan motor and turntable motor do not operate	<ol style="list-style-type: none"> <li>1. Shorted or open wiring</li> <li>2. Cooling fan motor</li> <li>3. Turntable motor</li> </ol>
8	Oven does not go into cook cycle Shorted or open wiring when START button is touched	<ol style="list-style-type: none"> <li>1. Primary interlock system</li> <li>2. Monitor fuse</li> <li>3. Magnetron or oven temperature fuse</li> <li>4. Relay (RYI)</li> </ol>
9	Oven is working but food is not getting heated up.	<ol style="list-style-type: none"> <li>1. Shorted or open wiring</li> <li>2. Magnetron</li> <li>3. Power transformer</li> <li>4. Rectifier assembly</li> <li>5. H.V. capacitor</li> <li>6. Primary interlock system</li> </ol>
10	Food is unevenly heated in the cook cycle.	<ol style="list-style-type: none"> <li>1. Shorted or open wiring</li> <li>2. Turntable motor</li> <li>3. Low voltage</li> <li>4. Dirty oven cavity</li> <li>5. Wrong operation</li> </ol>
11	Cooking Power not working properly	<ol style="list-style-type: none"> <li>1. Shorted or open wiring</li> <li>2. Control unit</li> </ol>
12	Defrost function not working	<ol style="list-style-type: none"> <li>1. Magnetron</li> <li>2. Wrong operation</li> <li>3. Low voltage</li> <li>4. Dirty oven</li> </ol>
13	The oven is in the sensor cooking condition but AH sensor does not end or AH sensor turns off about a maximum of 30 minutes after start. When a cup of water is heated by sensor, the oven does not shut off when the water is boiling. (This happens in few models)	<ol style="list-style-type: none"> <li>1. Control Unit</li> <li>2. AH Sensor</li> </ol>

The following figure shows a general work flow of repairing a faulty or a dysfunctional microwave oven:

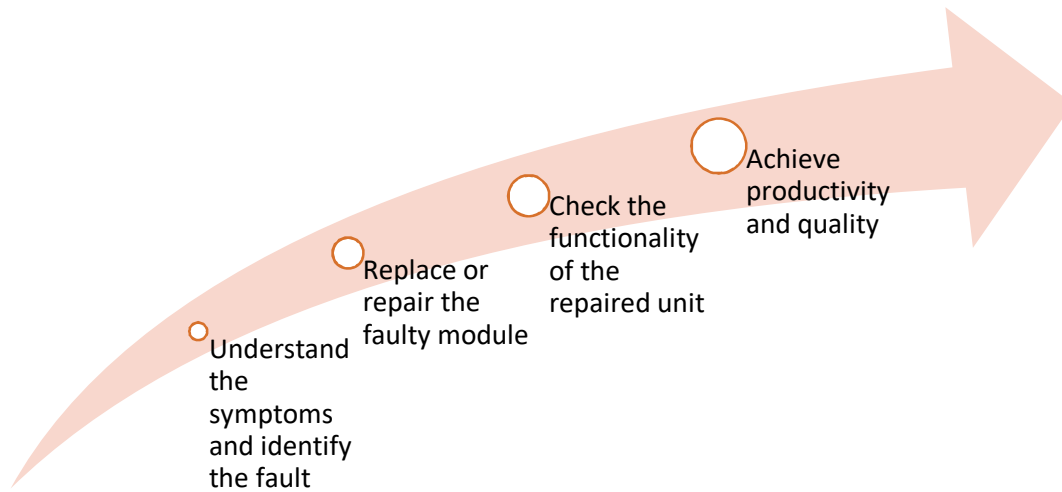


Fig 7.2.1: Workflow of repairing a dysfunctional UPS/Inverter

## Understand the Symptoms and Identify the Fault

It is very important for a technician to identify the fault in the microwave oven. Wrong identification of fault will lead to waste of time and money and it can also cause damage to the appliance. Some basic steps which need to be followed during fault identification are:

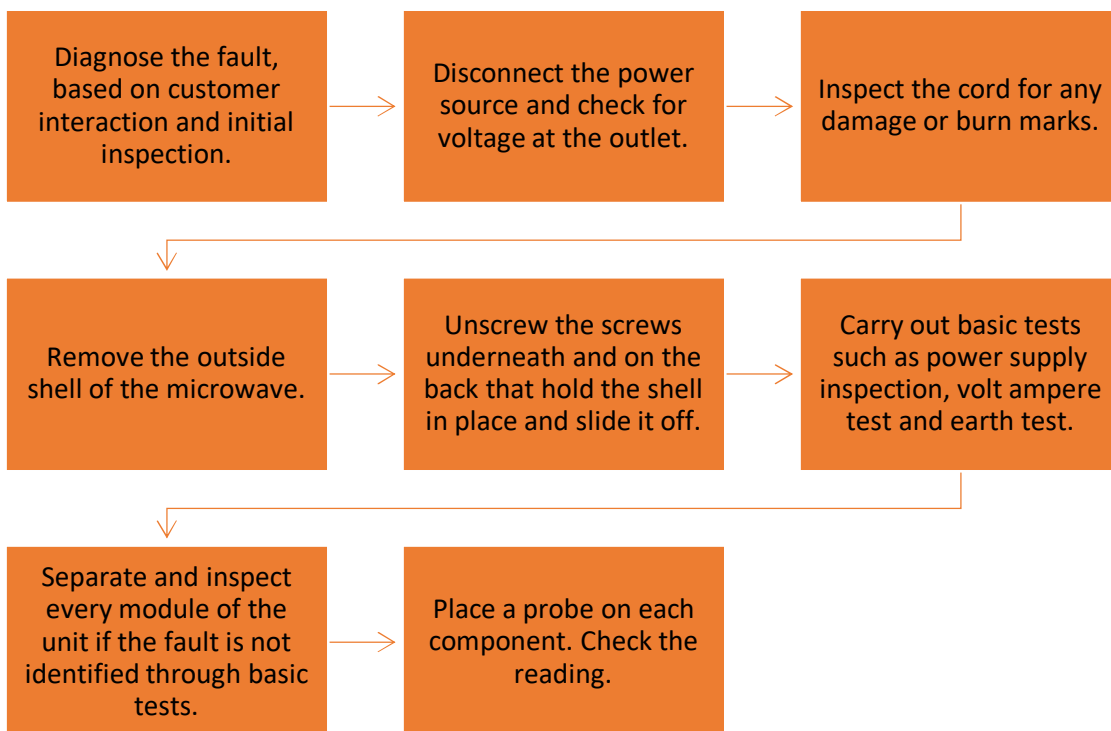


Fig 7.2.2: Workflow for understanding symptoms to identify fault in a microwave oven

## Faults and Symptoms of Dysfunctional Microwave Oven

It is important to understand the symptoms of the dysfunctional microwave oven for identifying the faults in it. The following flowchart represents the faults along with their potential causes and solutions:

- Problem 1: Cavity lamp does not light and oven does not operate

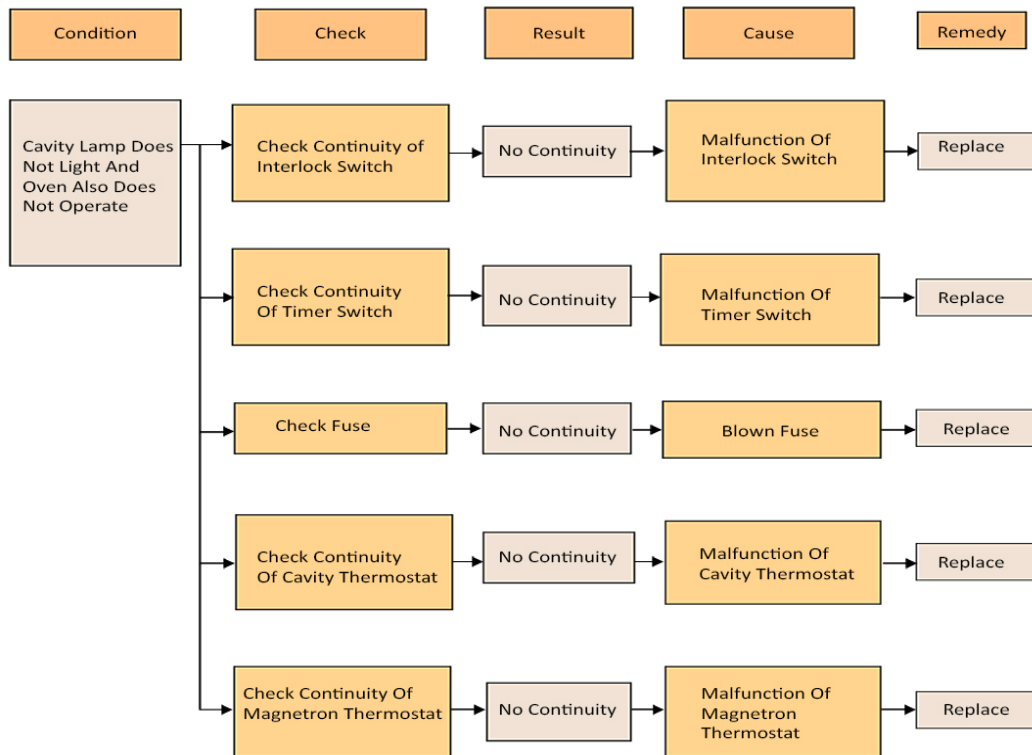


Fig 7.2.3: Flowchart for the given problem

- Problem 2: Oven does not operate but cavity lamp lights

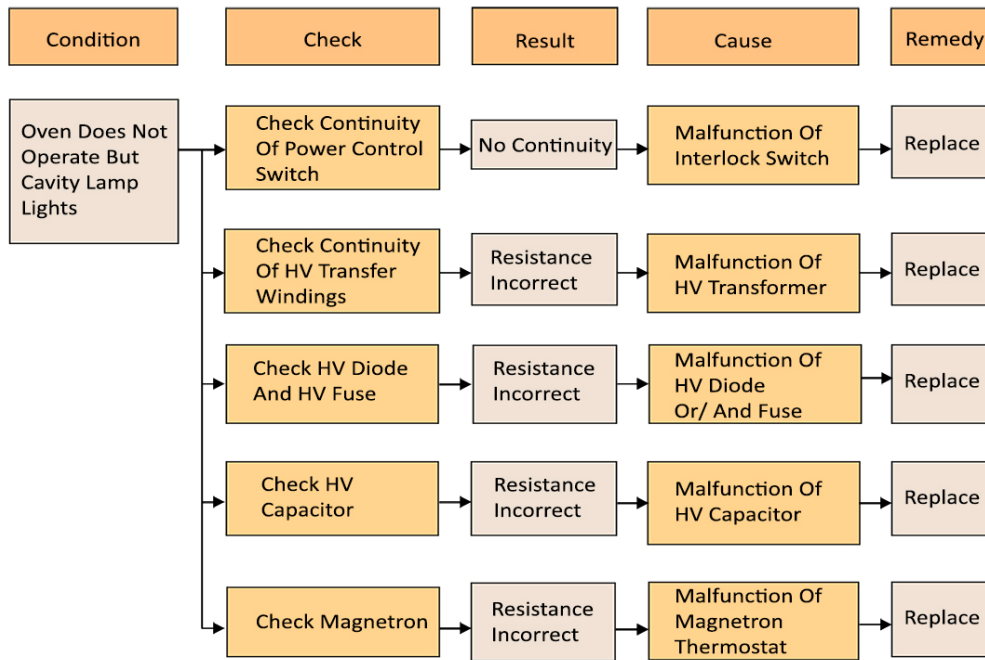


Fig 7.2.4: Flowchart for the given problem

- Problem 3: Oven operates for a few minutes and stops/Oven operates and does not stops/Output power is too low when cook is selected/Output power is high when defrost is selected.

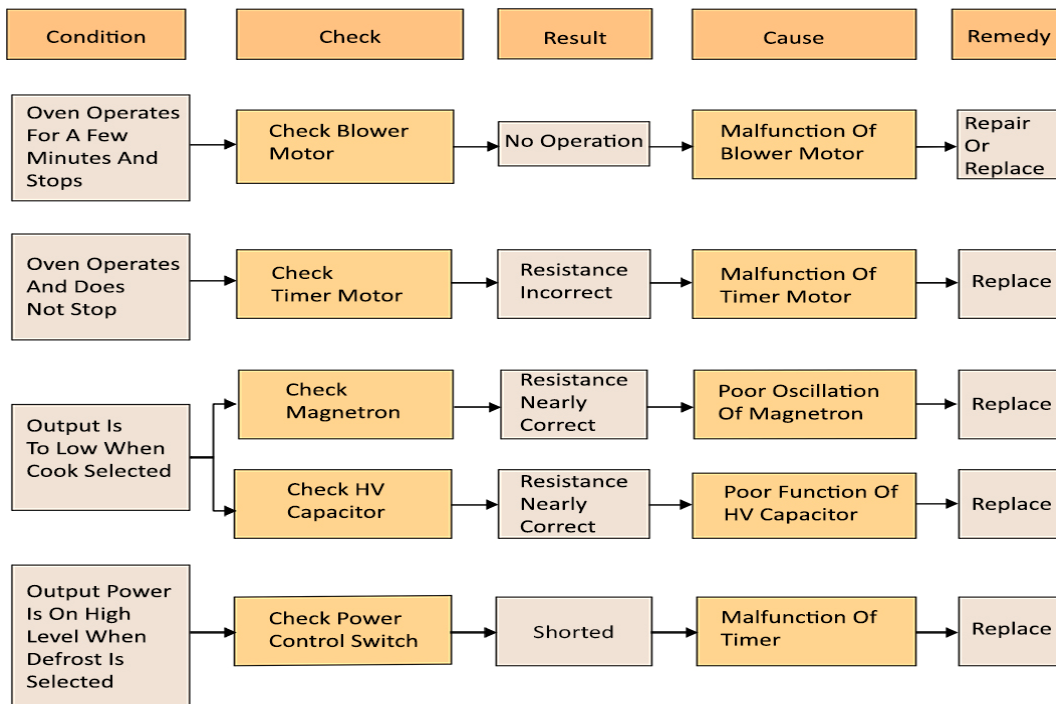


Fig 7.2.5: Flowchart for the given problem

- Problem 4: No microwave installation

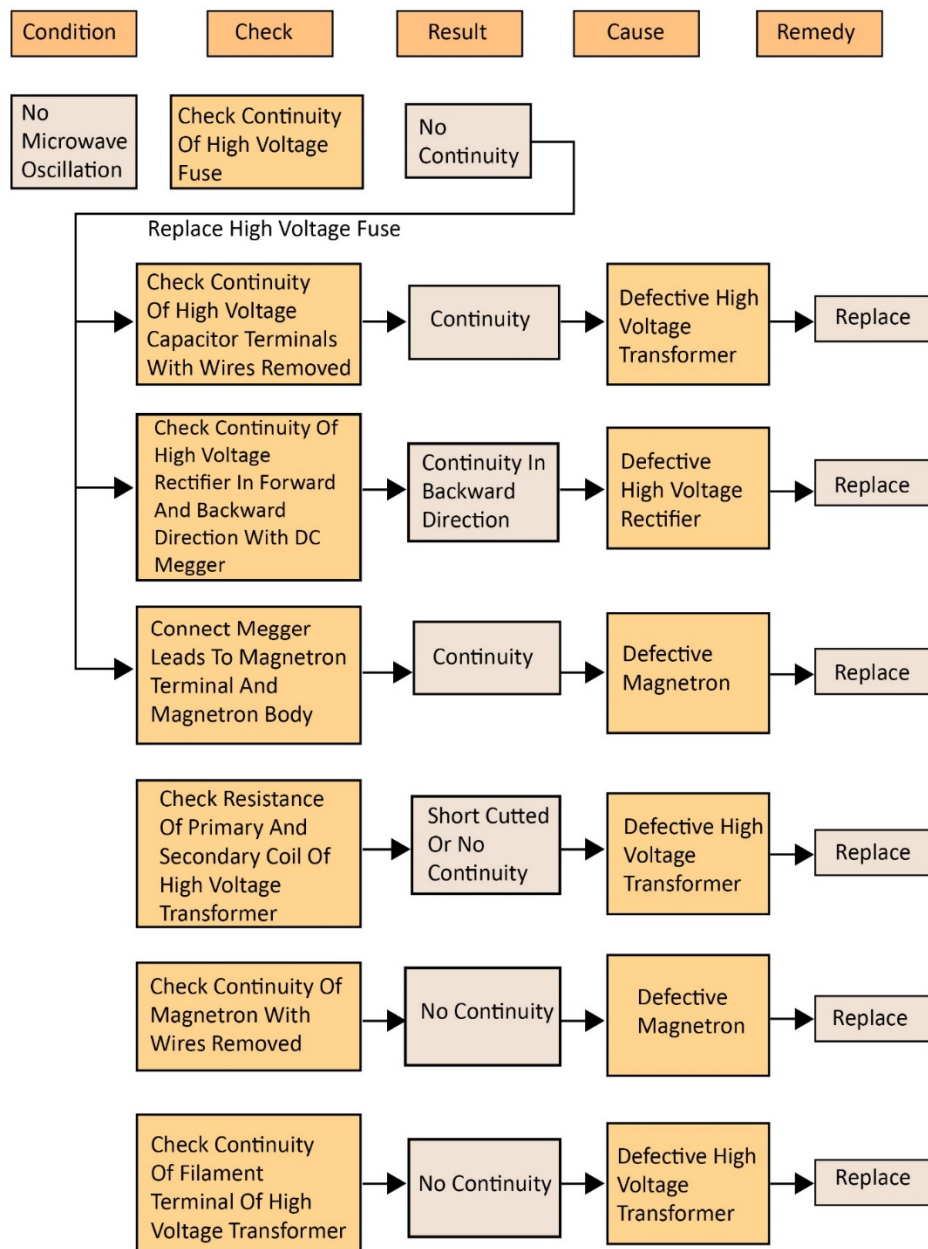


Fig 7.2.6: Flowchart for the given problem

Problem 5: Fuse blows

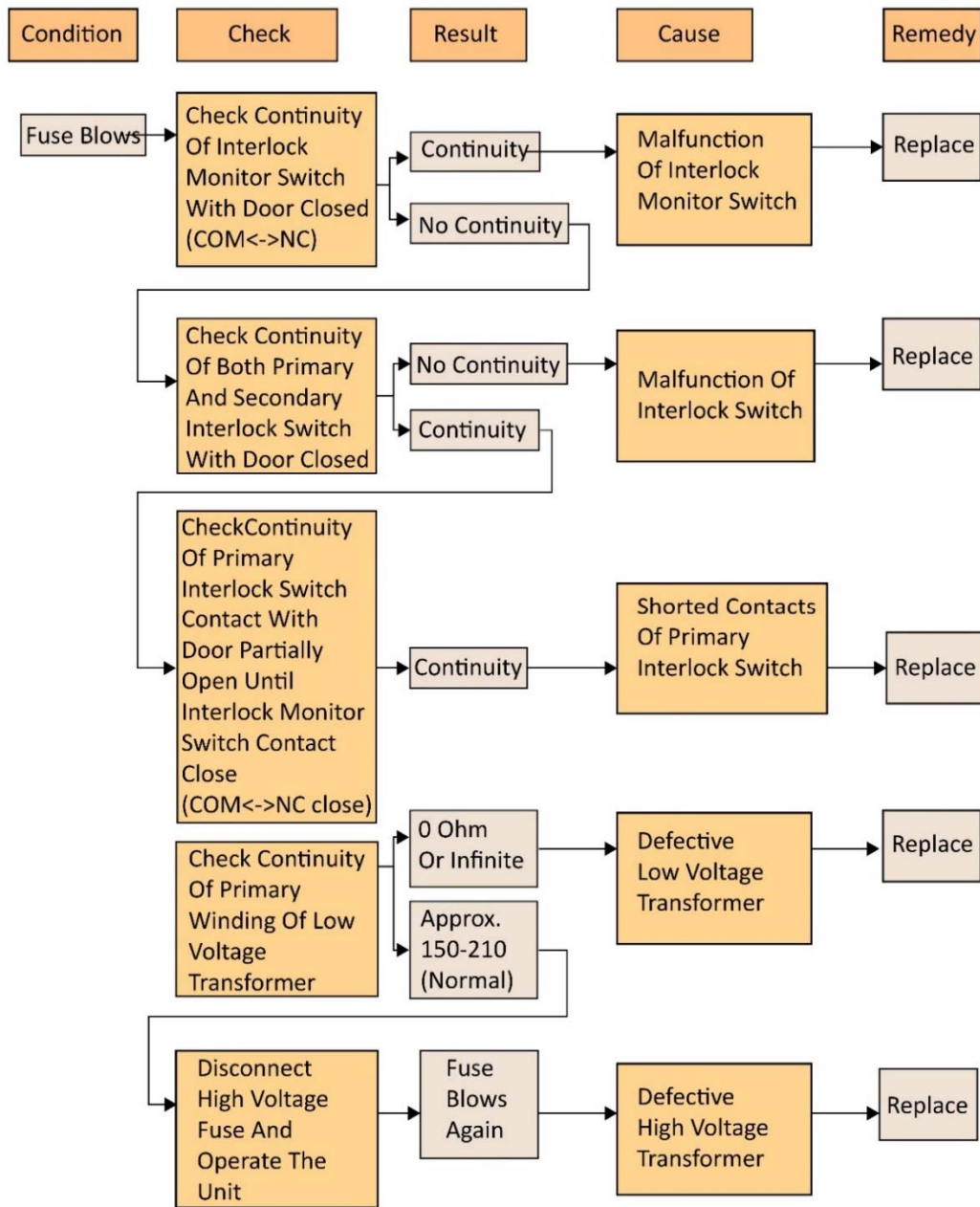


Fig 7.2.7: Flowchart for the given problem

## Repairing/Replacing of Dysfunctional Module in Microwave Oven

Sometimes only the connections of microwave oven needs to be checked and fixed. This can be done by a home appliance repair technician. But at times, a specialized technical help/support is required to repair internal circuits or fix a fault. If the first level maintenance cannot rectify a fault, then a trained technician is called. If even the trained technician cannot solve the issue, then a specialized technician associated with third-party or vendor is called.

In such a case, the specialized technician removes and replaces the faulty module with a functional unit, either on the second visit or as pre-identified.

In case even the specialized technicians are unable to repair the components or fix the fault, or if the problem is such that cannot be fixed at customer's site, then the faulty module/component is sent to the service centre. The home appliance repair technician then collects the functional module from the service centre and fixes the microwave oven at the customer's site.

### Confirmation of Functionality of the Repaired Module

Once the dysfunctional module has been repaired/replaced, check the new module with testing equipment such as multimeter and ammeter. This is done to ensure whether the module is working fine with the other parts of the microwave oven. After testing the connection, plug in the repaired oven to the power supply. Then, again check if the repaired unit is working properly or not.

### Achieve Productivity and Quality as per Company's Norms

To achieve productivity and quality as per company standards, a technician should follow the working instructions given by the company. To achieve productivity and quality practice the following:

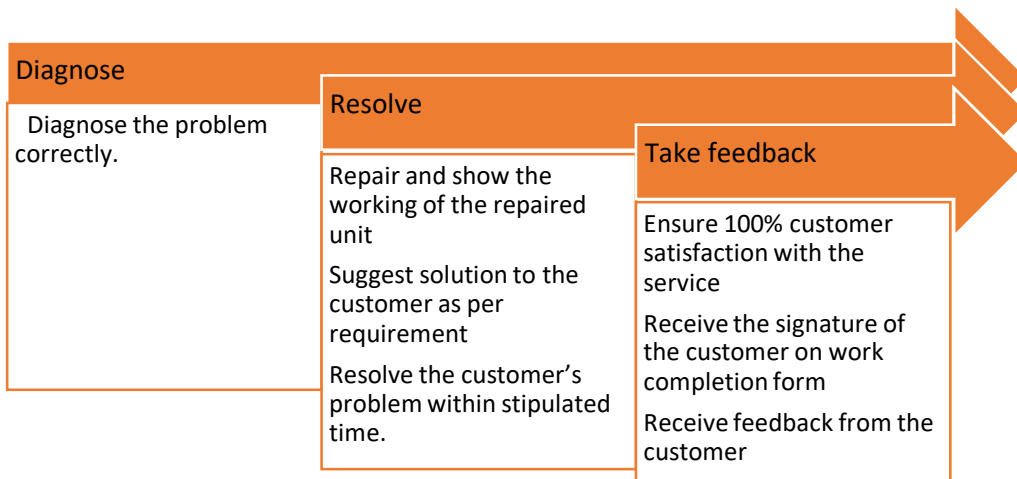


Fig 7.2.8: Work flow to achieve productivity and quality in repairing



## 7.2.2 Educating Customer Cleaning and Maintenance Procedure

Nowadays use of microwave has become quite common but no one gives a second thought for its proper maintenance/cleaning. Cleaning should be the foremost thing to be performed as it leads microwave ovens long life. The following figure lists the guidelines for maintaining microwave oven:

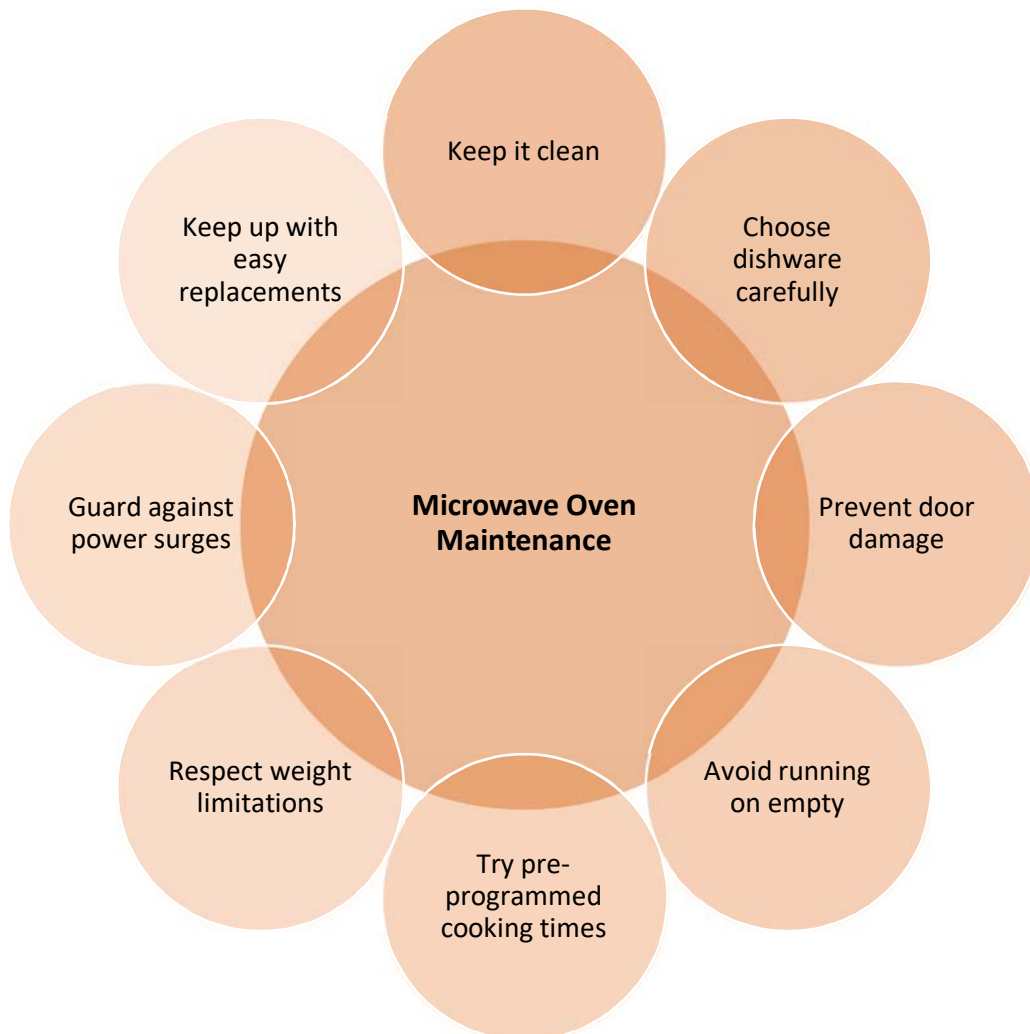
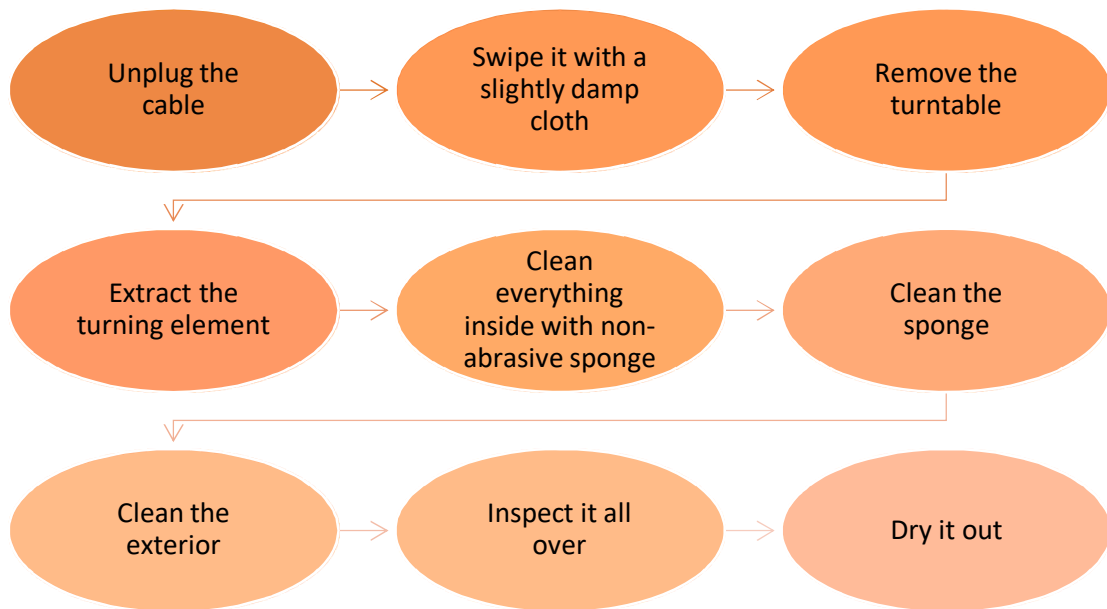


Fig 7.2.9: Guidelines for maintaining microwave oven

The following figure lists the steps to clean the microwave oven:



*Fig 7.2.10: Steps for cleaning microwave oven*

### 7.2.3 Documentation

After repairing, the technician must provide documents about the appliance worked upon, the information can include:

- Existing service contracts, guarantees and warranties
- Information about the replacement cycles for the faulty modules
- Records of repairs and replacements
- Records of items added, replaced, or removed
- Equipment and supplies inventory
- Maintenance service agreements; routine inspections, periodic maintenance and eventual renewal services
- Safety and test certificates
- Maintenance cost involved

**Practical** 

Test and replace interlock switches of microwave oven not working properly using multimeter and a power probe.

**Equipment:**

- Multimeter
- Power probe

**Hints:**

- Unplug the plug.
- Check the resistance by putting a multimeter across the AC input.
- Replace with switches.
- Check the marking on the old switch.

## Practical



Perform microwave leakage test.

### Equipment:

- Multimeter
- Power probe
- Microwave survey meter
  - Holaday HI-1500
  - Holaday HI-1501
  - Narda 8100
  - Narda 8200
- 600 cc non-conductive material beaker (glass or plastic), inside diameter: approx.8.5 cm (3 1/2 in.)
- Glass thermometer: 100 °C or 212 °F (1 deg scale) Insulation

### Hints:

- Place the beaker filled with water on the oven.
- Operate the oven at its maximum output power.
- Use a probe to measure the microwave radiations and monitor electromagnetic radiation.

**Practical**

Perform interlock continuity test.

**Equipment:**

- Multimeter
- Power probe

**Hints:**

- Perform primary interlock switch test
- Perform secondary interlock switch test
- Perform monitor switch test

## UNIT 7.3: Safety Rules

### Unit Objectives

**At the end of this unit, you will be able to:**

- Recognize safety measure performed before using microwave oven
- Practice safety measure while using microwave oven

### 7.3.1 Safety Measures before Using Microwave Oven

Microwave ovens are used in every household nowadays but only few people are aware about its proper placing. A microwave oven:

- Should be kept at an eye level or below.
- Should be kept at least at a distance of three feet from any combustible material.
- Should be kept at a distance from all such objects that block air vents or prevent air circulation.
- Should be plugged into an outlet directly.

Now as we have discussed about its placing, we must now understand how to operate it safely. The following figure lists the instructions to be followed for operating a microwave oven:

Read any warning messages, instructions, operating procedures and safety precautions.

Do not operate the unit when it is empty.

Do not use it for storage.

Do not operate if the door does not close.

Do not tamper with the safety interlock switches or the fuse.

Ensure safety mechanisms are in good working condition.

Report if the oven is defective.

Do not stand directly against or in front of an oven for long periods.

Do not leave food unattended.

*Fig 7.3.1: Instructions for operating microwave oven*

### 7.3.2 Safety Measure for Cooking in Microwave Oven

Before cooking in microwave oven follow the precautions given below:

- Check if utensils are suitable.
- Check wattage of microwave oven
- Check if the food is suitable for heating in microwave oven.
- Read the instructions carefully written on the food package before heating.
- Avoid charring the food.
- Be careful while removing food from the microwave oven to avoid being scalded.

The cookware and other substitute to be used for cooking in microwave oven should be known to avoid any mishap from occurring. The following figure lists the cookware which are safe to use and the ones that to use while cooking in a microwave:

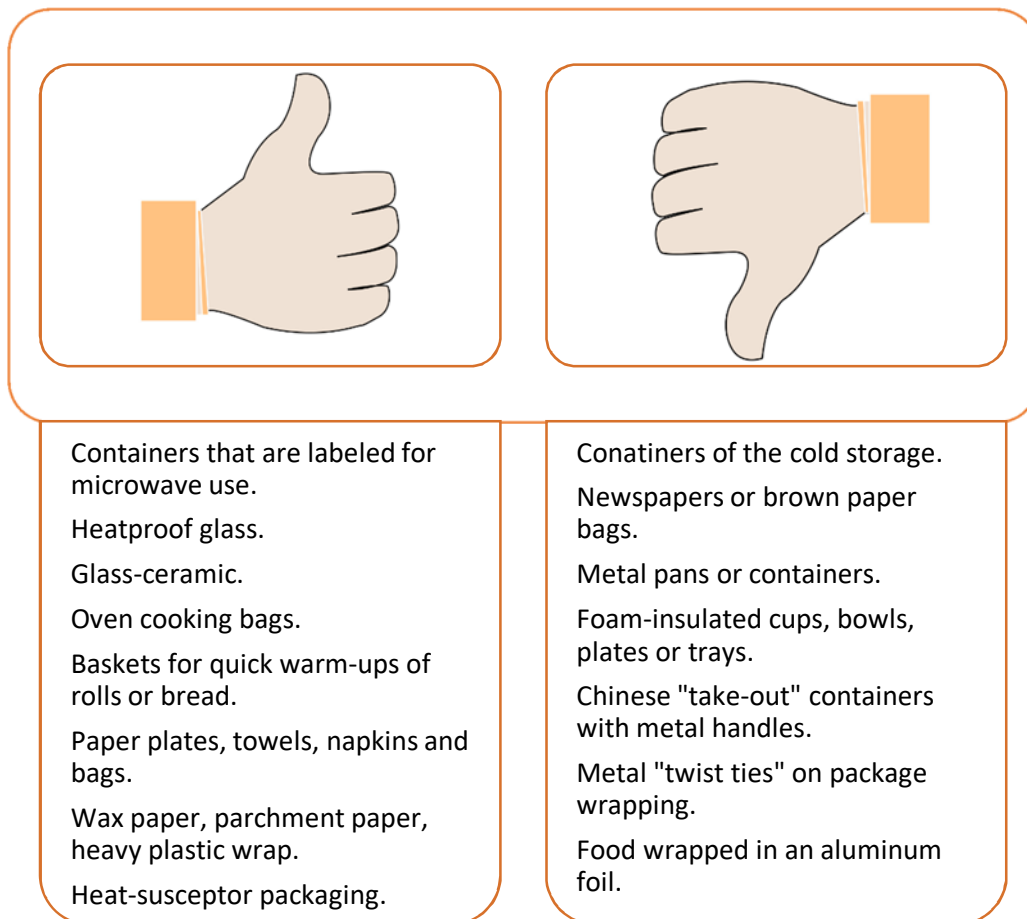


Fig 7.3.2: Safe and unsafe cookware for microwave oven cooking

#### Tips

When using a plastic wrap for wrapping the food, don't let it touch it. Keep some space to let the steam escape.

The following figure lists the general guidelines for using microwave oven:

### To prevent fire

Any combustible object should not be placed near a cooking oven.  
Any utensil with metal ingredients should not be used in a microwave oven.  
Any operating electric cooking oven should not be left unattended.

### To avoid glass cracking

Any water splash on the hot viewing glass should be avoided.

### To avoid explosion

Any uncooked egg (with or without shell) or nut should not be heated in a microwave oven.  
Any sealed cans or bottles of food should not be kept in the microwave oven.

*Fig 7.3.3: General guidelines for using operating microwave oven*



**Activity: Role Play** 

You are assigned the task to service a microwave oven at a customer's site. You reach the customer's site and see that microwave oven is not placed properly neither it has been cleaned for a while. What will you do?

**Activity: Group Discussion**

Get together in groups of three or four. List down the cookware that is safe to use for cooking in microwave oven and the ones that not safe. Use the following table to make the list.

Safe	Unsafe

## 8. Interacting with Co-workers



Unit 8.1 – Interact with the Supervisor

Unit 8.2 – Interact with Colleagues

Unit 8.3 – Interact with Customers



## Key Learning Outcomes



**At the end of this module, you will be able to:**

- List the work requirements
- Maintain interpersonal skills
- Evaluate non-biased feedback
- Recognize different functions
- Describe interpersonal and decision making skills

## UNIT 8.1: Interacting with the Supervisor

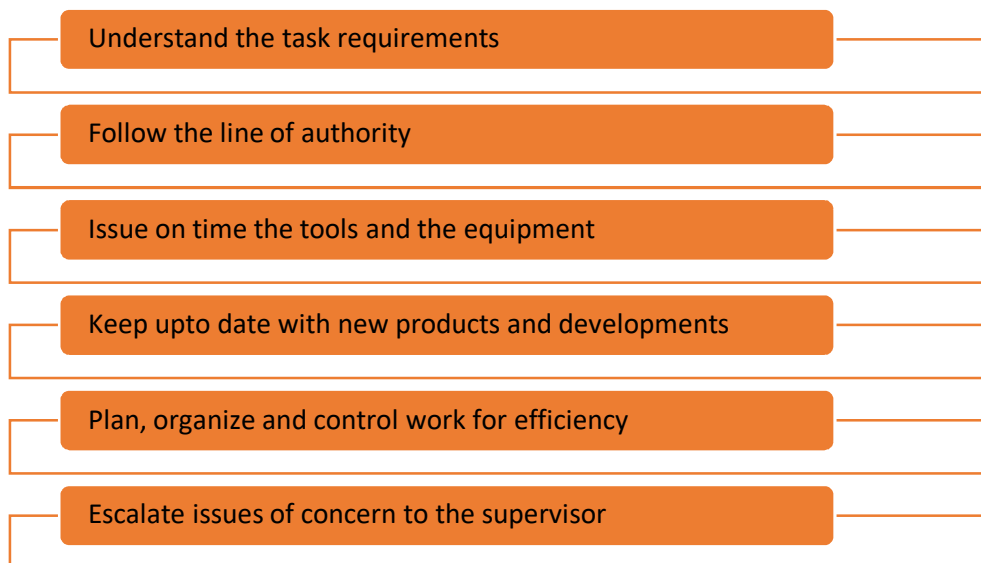
### Unit Objectives

**At the end of this unit, you will be able to:**

- Recognize the work requirements
- Use inter-personal skills to resolve issues
- Communicate with superior and subordinates
- Evaluate non-biased feedback from client regarding task completion

### 8.1.1 Work Requirements

As a home appliance repair technician, one of the major roles and responsibilities is to understand the work requirements. The work requirements include certain responsibilities as shown in the following figure:



*Fig. 8.1.1: Responsibilities of a technician*

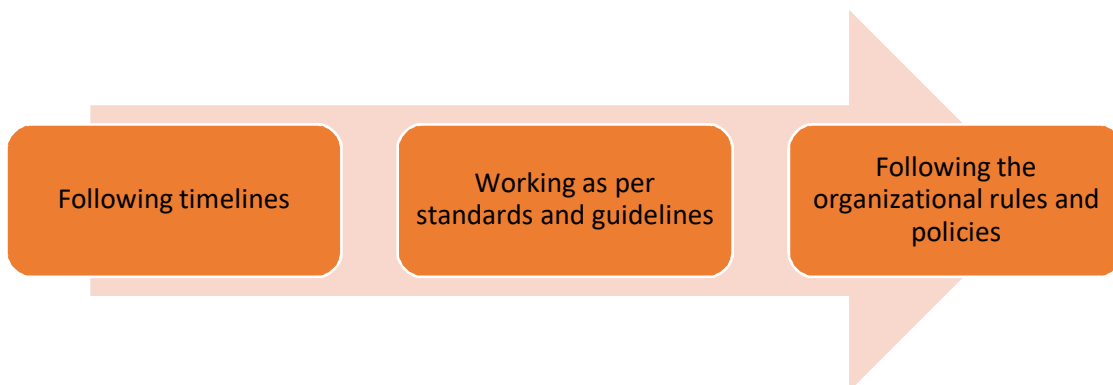
Having a clear picture of the work requirements determines the smooth functioning of the process of installing, maintaining and repairing the appliances.

Any ambiguity in understanding the work requirements defined by the supervisor results in time delays and confusions. A home appliance repair technician must avoid such instances at all costs. Understanding the technical requirement is also equally important. While replacing faulty modules, a technician should check their warranty and also ensure that no damage has been done to the other hardware.

Once the issue/problem is solved, feedback from the customer is very important. It helps to create a reference guide for the home appliance repair technician if the same problem creeps up again, having discussions with the supervisor in relation to the problem and its solution solves a lot of intangible problems.



Abiding by the work ethics is also essential. It means differentiating between the right and the wrong way of doing a job and adopting the right conduct. Work ethics involve certain principles as shown in the following figure:



*Fig. 8.1.2: Work ethics*

A field technician needs to take care of all tools and equipment. In addition, work ethics would include the technician taking self-care by using the safety tools and equipment and following the safety procedures.

The person may come across a situation that may require escalation of the situation to the supervisor, as shown in the following figure:

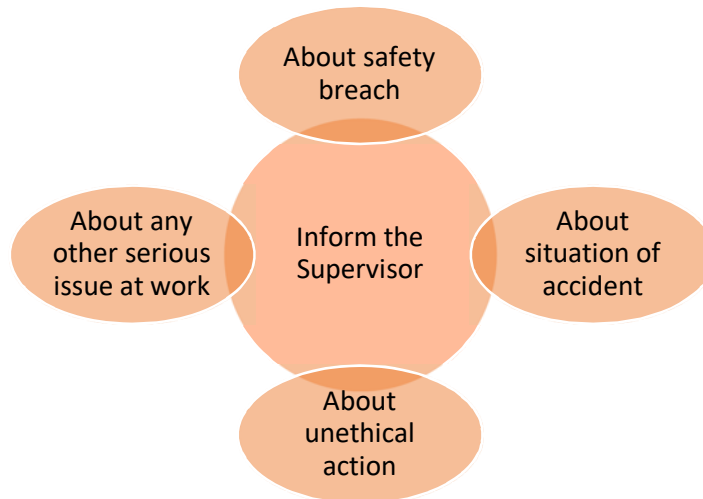


Fig 8.1.3: Issues to be informed to the supervisor

## 8.1.2 Work Process Improvement

To ensure work process improvement, a technician must adhere to the practices as listed in the following figure:

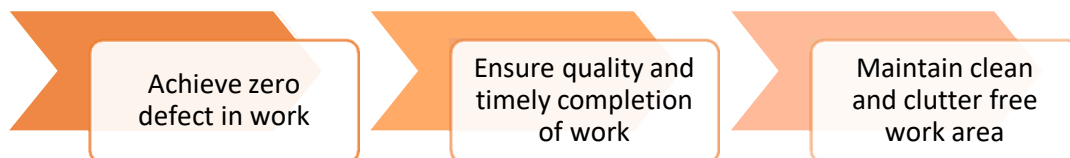


Fig. 8.1.4: Process for improving work

Zero defect in work can be achieved by the ways as shown in the following figure:

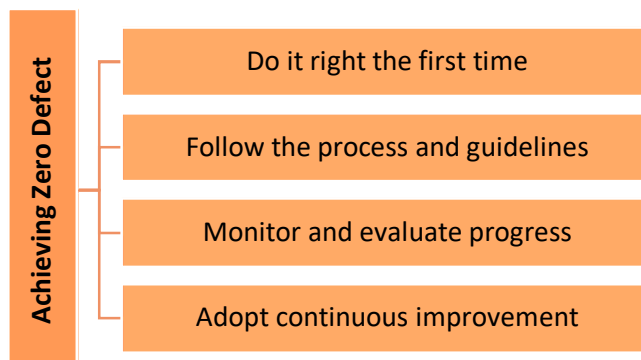


Fig. 8.1.5: Measures to achieve zero defect in work

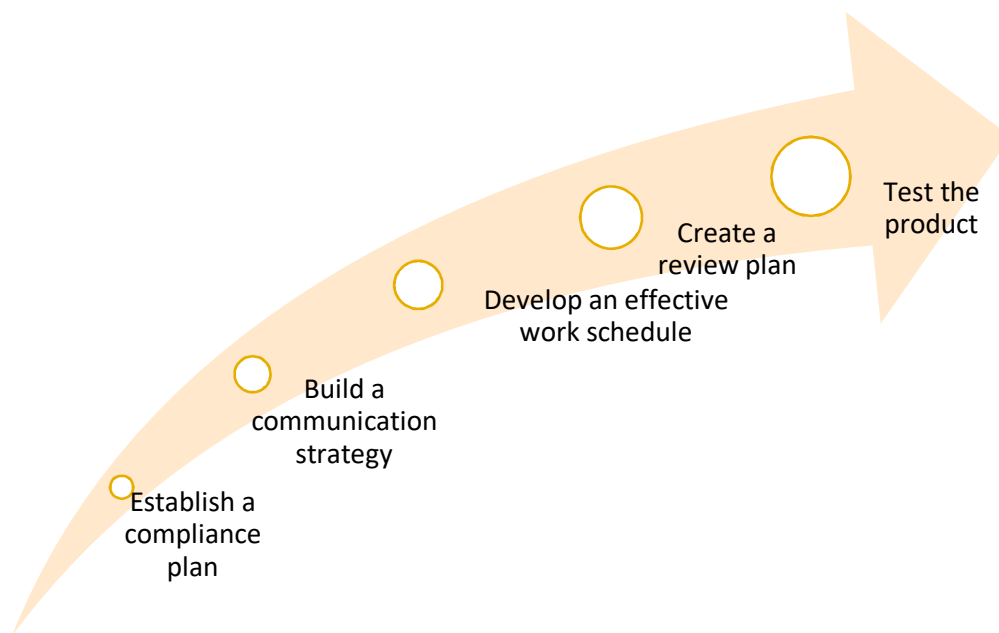
A technician can maintain quality and achieve timely completion of work in the following ways:

- Ensure whatever work is done is as per the guidelines and standard of the company
- Plan and organize the work for the day
- Follow the plan
- Inform the supervisor in case of any deviation or emergency

The supervisor shares a plan of action with the technicians to ensure adherence to timelines and quality for the work assigned. Therefore, a supervisor's responsibilities includes the following:

- Planning the task
- Getting the task done from others
- Organizing and controlling work for efficiency
- Looking after interpersonal issues

The following figure highlights the points which help the technician in understanding the plan to achieve 100% quality and timely completion of work:



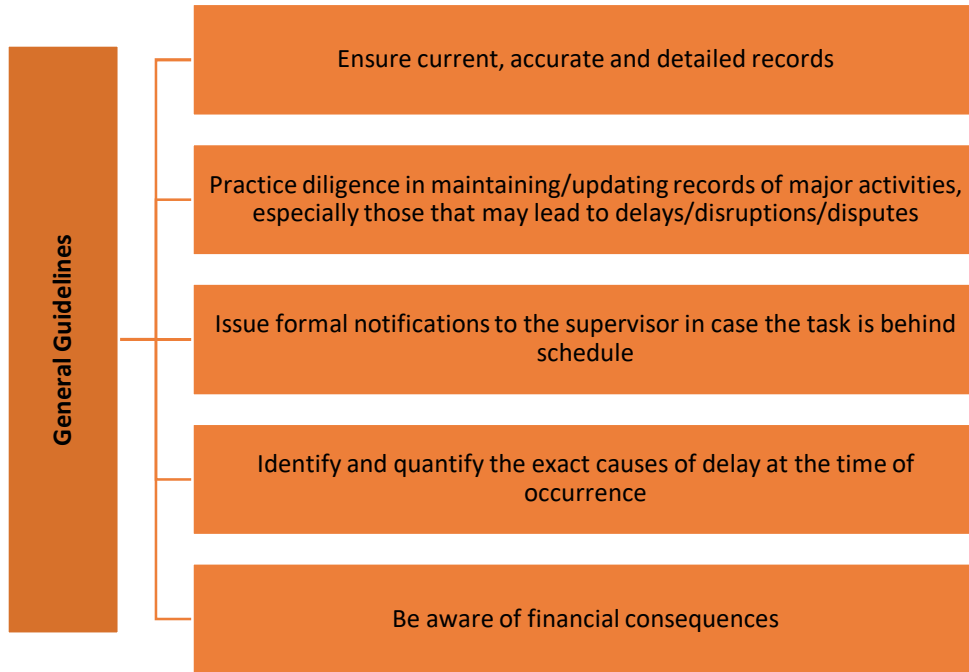
*Fig 8.1.6: Achieving quality and timely completion of work*

### 8.1.3 Spot Process Disruptions and Delays

Delays and disruptions are common while working as a technician. Certain guidelines must be followed to resolve issues in case of disruptions and delays.

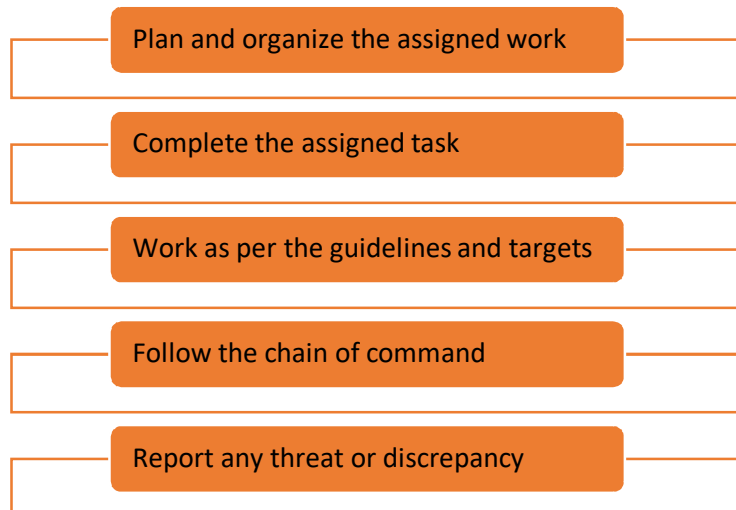


The following figure lists the general guidelines to follow in such cases:



*Fig. 8.1.7: General guidelines to follow in case of disruptions and delays*

The following figure highlights the points which an employee, a technician, must abide by while interacting with the supervisor:



*Fig 8.1.8: Points to adhere to while interacting with a supervisor*

### 8.1.4 Inter-personal Skills

A home appliance repair technician not only needs to be acquainted with all the technical requirements of the appliance, but also needs to have interpersonal skills to solve meagre issues. Communication and the aptitude to solve problems, as and when they occur, is an important skill set which helps in the long run. The ability to report problems in accordance with the guidelines and understanding ability of the supervisors and the higher management is preferred. A home appliance repair technician also needs to be skilful enough to resolve personnel grievances tactfully.

#### Report Problems in Field

Home appliance repair technician needs to report all kinds of problems to the supervisors, keeping in mind the code of conduct. Proper communication of any kind of issue in the facility is important as misleading information can complicate the issue further.

#### Resolve Personnel Issues

The following figure lists methods to resolve personnel issues:

Communicating effectively with the personnel ensures positive feedback in the organization. Two way communication within and beyond the facility is also advised.

All conflicts of interest, misunderstandings and personnel grievances need to be understood and then reported to the higher authority.

Suggestions on resolving the problems is important as it helps the facility staff to concentrate on the job at hand.

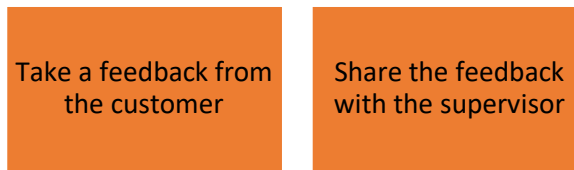
*Fig. 8.1.9: Methods to resolve personnel issues*

Any personal issue or grievance also needs to be attended by the home appliance repair technician himself before pushing the issue through to the supervisors. Managing the personnel is the most important part of team effort aiming towards a unified goal.

### 8.1.5 Customer's Feedback

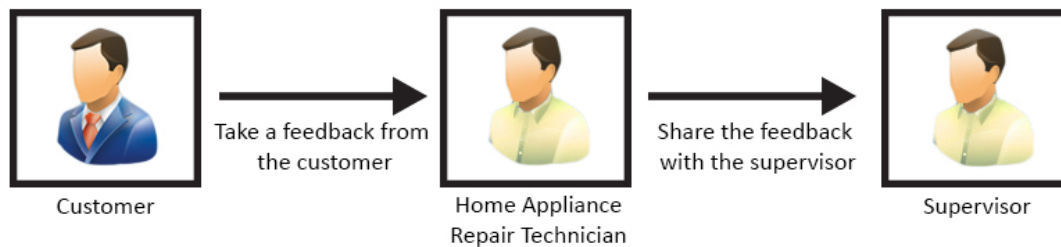
A customer is always special for an organization and therefore, the customer's feedback is the most important aspect of providing service for an organization.

A technician should take the customer's feedback as shown in the following figure:



*Fig 8.1.10: Procedure to be followed for taking a customer's feedback*

To maximize the potential of work done in an organization, a home appliance repair technician needs to make it a habit to get unbiased feedback from the customers on the designated tasks performed. The customer is always special and the customer's feedback is essential for an organization. The procedure as shown in the following image should be followed:



*Fig. 8.1.11: Procedure to be followed for taking customer's feedback*

The time taken to resolve an issue and the difficulties that a customer encountered while communicating the problem should be understood. The misunderstandings observed during the interaction should be clearly documented.

The methods of interaction and behavioural aspects also need to be considered in drawing conclusions after each task or problem handling routine. Getting honest feedback from customers helps to improve the organizational functioning.

**Activity: Role Play** 

You are a home appliance repair technician. You just received a phone call from customer reporting to escalate the issue directly to the supervisor as the water purifier installed in his office is giving dirty water post 1 hour of installation. How should the situation be handled?

## UNIT 8.2: Interacting with Colleagues

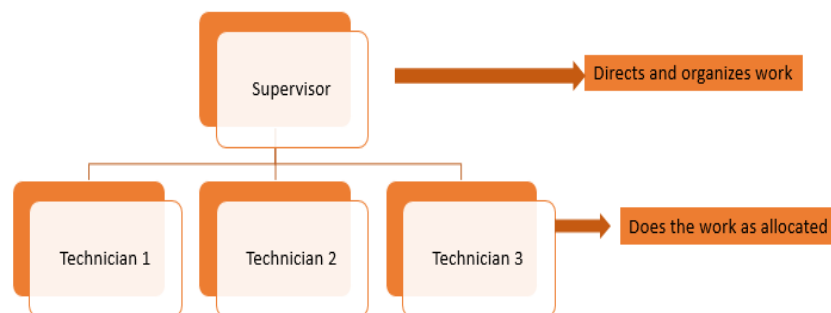
### Unit Objectives

**At the end of this unit, you will be able to:**

- Explain how to achieve inter-personal communication in an organization
- Identify the different aspects while interacting with a colleague

### 8.2.1 Role of Team Members

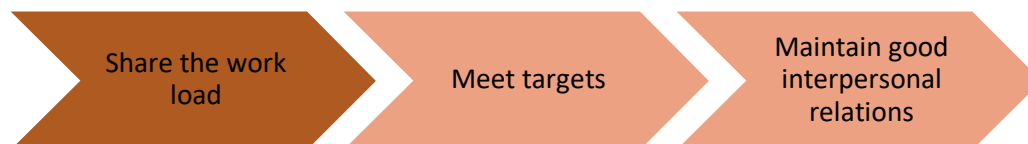
A team is formed when a group of people work together with an objective of achieving some goals and targets. Working as a team helps to understand the work and also have a better co-ordination at work. The following figure shows the roles of team members and their work:



*Fig 8.2.1: Roles and responsibilities of team members*

### 8.2.2 Interact with Colleagues

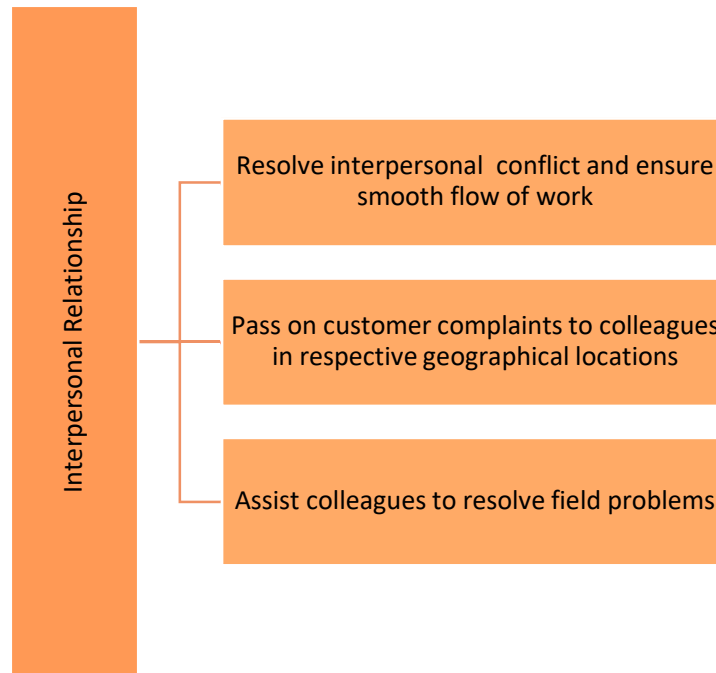
The following figure lists the key points to consider while interacting with colleagues:



*Fig 8.2.2: Key points while interacting with colleagues*

## Interpersonal Relationship

To maintain a healthy interpersonal relationship, it is important to adhere to the points shown in the following figure:



*Fig 8.2.3: Managing interpersonal relationship*

Every worker works towards a common goal in an organization, still all of them are divided by certain roles and activities and the way they accomplish that objective. Inter-personal communication – whether formal or informal - is the most common and important key to accomplish productivity and perform social functions in an organization. It defines form and functionality of an organization as all work groups require an active inter-personnel communication to accomplish productivity.

The primary objective of a technician is to understand the process and the health of the communication taking place among the co-workers in order to improve its quality. Doing so enables the technician to comprehend the way groups interact and work. The following figure shows the steps for ensuring spontaneous inter-personal communication:



*Fig. 8.2.4: Steps for ensuring spontaneous inter-personal communication*

A technician should be able to install and repair the home appliance. A technician is supposed to have the skills to:

- Know the use and care of the various tools and equipment
- Read and interpret complaint sheets and manuals
- Use various safety equipment while at work
- Apply the knowledge of electrical and electronic components

A workplace that feels like a battlefield requires inculcating a sense of harmony and unity. These are the keys to develop a healthy and competitive environment in any type of an organization. Higher the rank, bigger are the responsibilities and more complex are the problems.

The work group is united by the goals and missions of the organization but, at times, small issues like varied viewpoint plague the work environment. Keeping everyone focused and motivated to work in synergy is what the role of a technician is.

### Customer Complaints in the Respective Geographical Area

Serving customers in an organization with a wide spectrum of consumer base poses additional challenges. Maintaining service quality in such cases can be a challenging task, owing to cultural and social diversity. However, such barriers can be overcome in a better way by giving opportunity to a worker hailing from the respective geographical area. Addressing such problems in this way can improve the ability of an organization to implement strategies aimed at improving the service quality. The following images show segmentation of customer base to collect their complaints accordingly:



Fig. 8.2.5: Segmentation of customer base

### Assist Colleagues

Be it work allocation, manpower distribution or identification of areas of high responsiveness, healthy communication is the key to improve service quality. Informal communication is what is usually seen to be dominant in most workplaces. People asking for help from the person sitting at the adjacent desk to troubleshoot an IT issue, rather than consulting an IT person, is one of the most common examples of informal communication. The communication is spontaneous and successful in achieving the goal, paving the way to formal inter-personal communication. Despite having established communication procedures, the informal communications occur in every organization and help in resolving problems and conflicts in real time.

### 8.2.3 Interact with Colleagues from Different Functions

A work environment where teamwork is a culture, always yields more results than a low-morale and individual work environment. This is because generally everyone cares about people they work with. Taking onus of an assigned job role and getting it done in collaboration with people from other departments makes an effective work relationship and a win-win situation for both.

#### Understand their Workload

Developing a culture of teamwork is an important step. Training to work flawlessly as a team is the next step towards building a cross functional communication for pursuing a long-term goal because a close-knit work environment positively affects a team and the individuals. Be it by understanding the stress level and workload of others or by simply participating in small victories they make while overcoming hurdles in day-to-day work, building relationships with people of other departments strengthens an organization in unexpected ways.



**Activity: Role Play** 

You are a home appliance repair technician. You are given the responsibility of providing personal training to a colleague about the repairing of small appliances such as mixer grinder. The person is not able to cope with the functionality of the appliance due to non-understanding of an easy to learn skill. Handle this situation.

## UNIT 8.3: Interacting with Customers

### Unit Objectives

**At the end of this unit, you will be able to:**

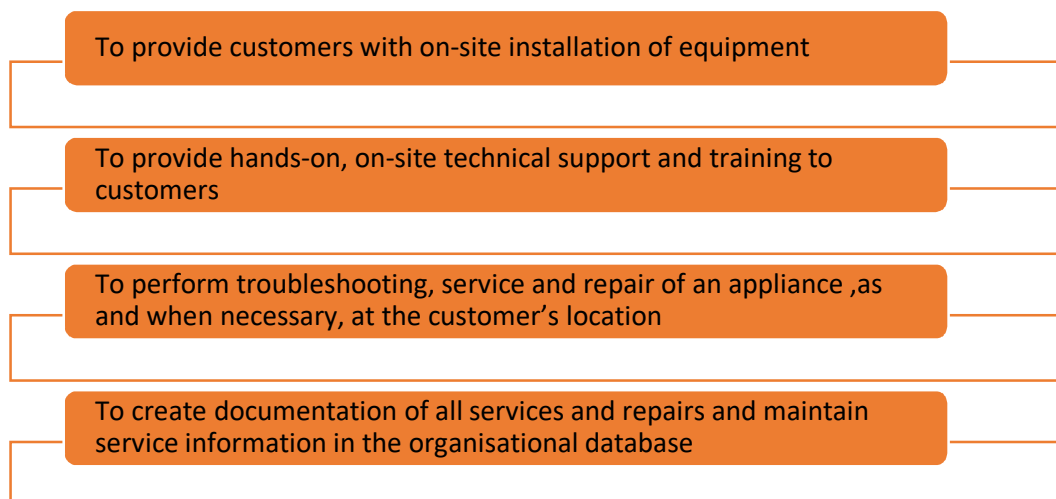
- Communicate with customers
- Develop rapport with customers
- Develop interpersonal and decision making skills

### 8.3.1 Introduction

As a home appliance repair technician, there are certain roles that come by default. Yet, the job requisite of the technician remains to install, repair and service home appliances. Since, they are involved largely in maintaining and servicing worn out electrical equipment, they are also known as field technician.

The home appliance repair technician is required to review each electrical component of an appliance after a specific period of time. The idea is to find faults and then rectify them to avoid major failures in the near future.

In the role of a home appliance repair technician, an individual has to fulfil a host of responsibilities. Major responsibilities are as shown in the following figure:



*Fig. 8.3.1: Major responsibilities of a home appliance repair technician*

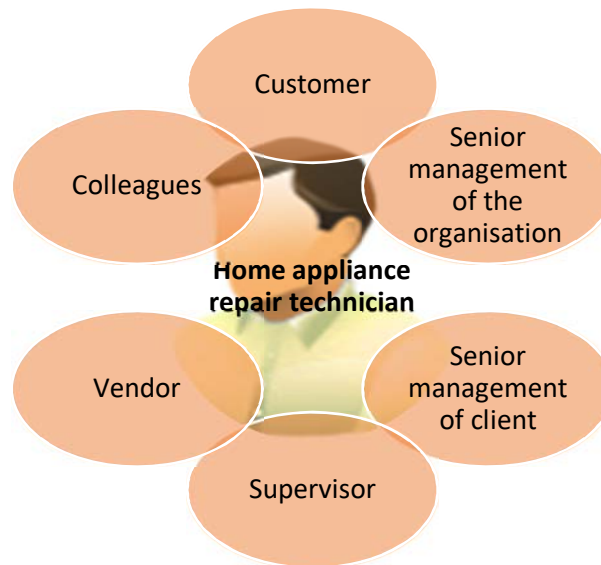
### Working with Customers

Home appliance repair technicians are required to professionally handle customer service calls, address issues arising from field service visits and ensure customer satisfaction.

Good communication skills can help a technician to build rapport with a customer. Built up trust ensures that the customer can explain the problem in detail. Detailed information can decrease the technician's turnaround time, limiting disturbance in the customer's workflow.

### 8.3.2 Communication Skills

Home appliance repair technicians need to be excellent communicators to ensure their work is properly understood by the customers, colleagues and superiors. The following figure lists the persons with whom they have to communicate:



*Fig. 8.3.2: Persons with whom a home appliance repair technician communicates*

The technician may also be required to communicate in the local language to understand the customers' queries and suggest to them appropriate solutions where service alone would not solve the purpose.

### Seeking Details to Assess the Problem and Suggesting Solution to Customer

Each customer will have a different problem and a very different idea of what customer services means. Therefore, to provide appropriate customer service, a home appliance repair technician must be able to communicate well to understand the customer's needs and provide accurate solution to the problem.

Without details, the technician cannot assess the problem correctly. Also, without being able to provide service on-site, the person is of no use. Thus, it is important to communicate to understand the area of issue properly. A detailed investigation alone will lead the technician to the root of the problem, which will then become easy to solve.

As a customer service representative at the customer's location, a home appliance repair technician may be required to tell the customer what they want to hear, but that is not a good practice, even though all representatives are trained to do so. The correct thing will be to suggest real solutions to the customer. To ensure customer satisfaction, the home appliance repair technician must do the steps as shown in the following figure:



Fig. 8.3.3: Steps to ensure customer satisfaction

## Assisting and Educating Customers about Warranty and Precautions

A home appliance repair technician on an on-site visit to a customer's location must detail the requisites regarding warranty. This will educate the customer on whether the appliance is in warranty or not. The following figure lists some important information that a home appliance repair technician should communicate to the customer:

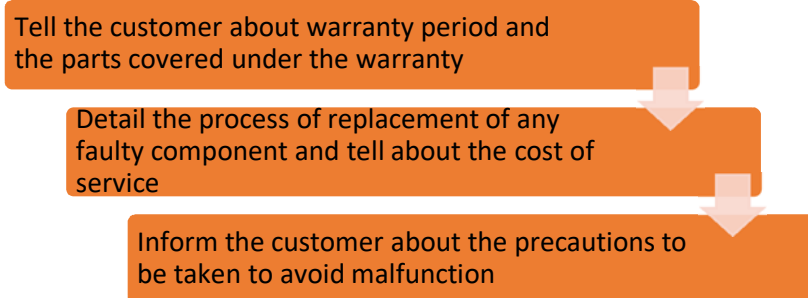


Fig. 8.3.4: Information to be shared with the customer

### 8.3.3 Interpersonal Skills

The work of a home appliance repair technician is not just technical; the job role requires the individual to frequently liaison with customers. Additionally, the technician also has to work in multi-disciplinary teams and interact with colleagues and seniors. Therefore, the individual is required to have strong interpersonal skills.

Good relationship with the customers and vendors is vital. However, it is equally important to ensure that the relationship is documented properly, so that the decisions on the relationship can be taken in accordance with it. The following figure shows essentials of interpersonal skills:



Fig. 8.3.5: Essentials of interpersonal skills

### Managing Vendors and Building Rapport with Customers

In addition to being a skilled technician, a specialist home appliance repair technician also has to adopt the role of a good bargainer and become a good face of the organisation – as he has to deal with vendors to close deals and provide on-site customer assistance. The individual has to liaison with customers and vendors and interact with them to understand and explain details provided in the service level agreement.

When dealing with vendors, a home appliance repair technician presents a detailed work requirement and makes self-assessment of the requirement. Talking and detailing the essentials, the technician finalizes a deal that is mutually beneficial for both the organisation and the customers in the long run.

Outside the purview of the organisation, home appliance repair technicians are as good as customers judge them to be. It is essential for them to build rapport with the customers to better understand their problems and address them to perfection. The following figure lists the benefits of building rapport with the customers:

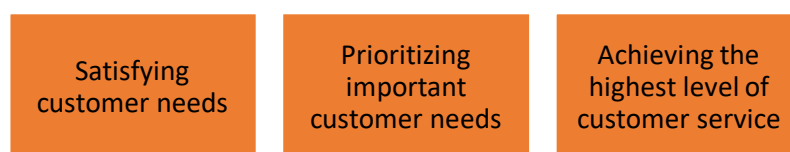


Fig. 8.3.6: Benefits of building rapport with the customers

### 8.3.4 Behavioural Skills

With the good comes the bad; this phrase just becomes right when dealing with difficult customers. Most of the time, this may be because of uncontrollable situations such as a manufacturing defect. But, at times this can be related to service or after sales issues. In either case a home appliance repair technician has to keep a cool head and deal with the issues maturely.

The technician should collaborate and communicate clearly the issue to the customer and in some cases if it is necessary, to the superiors. The individual should be able to see the bigger picture while deferring perspectives and effectively prioritise situations.

A home appliance repair technician working effectively on the field can be professionally groomed to handle situations. The individual should continuously strive for improvement in etiquette while dealing with customers, so that even the most difficult of customers can return with satisfaction and goodwill.

#### Dealing with Customers

Primarily, the home appliance repair technician must listen to the customer, even if the viewpoint is the same – let the customer vent it off. After the customer has finished, the individual must express feeling and apologize for the inconvenience in a supportive way. The technician must provide immediate response to the problem detailed by the customer, if possible. At times, it may mean bending the rules, but customer satisfaction is the key to success and going out of the way can just hit the nail on its head.

### 8.3.5 Decision Making Skills

Decision making is a difficult skill to hone. Nearly every decision involves some sort of conflict or dissatisfaction. But the difficult part is – decisions have to be made – and a home appliance repair technician generally has to make decisions on the fly.

Decision making is necessary majorly in case of dissatisfied and difficult customers. There can be an odd situation when the issues at hand are beyond the permissible limits of a technician's profile. This is when decision has to be made whether to take up the query to a superior or just escalate the issue with the vendor.

**Activity: Role Play**

You are a home appliance repair technician. You just received a phone call from an angry customer, who has complained of an explosion inside the microwave oven just after the routine check by you. The food being cooked in it has been splattered all over. How should the situation be handled?





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Skill Council for Persons with Disability

**Skill Council for Persons with Disability**

Sector Skill Council Contact Details:

**Address:** 501, City Centre, Plot No. 5 Sector 12 Dwarka New Delhi - 110075

**Website:** [www.scpwd.in](http://www.scpwd.in)

**Phone:** 01120892791